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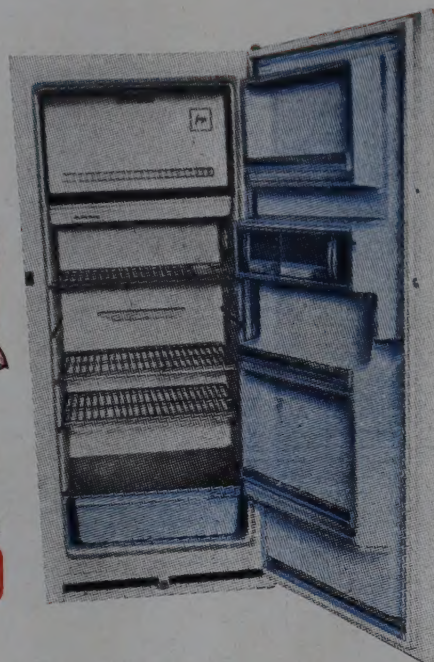
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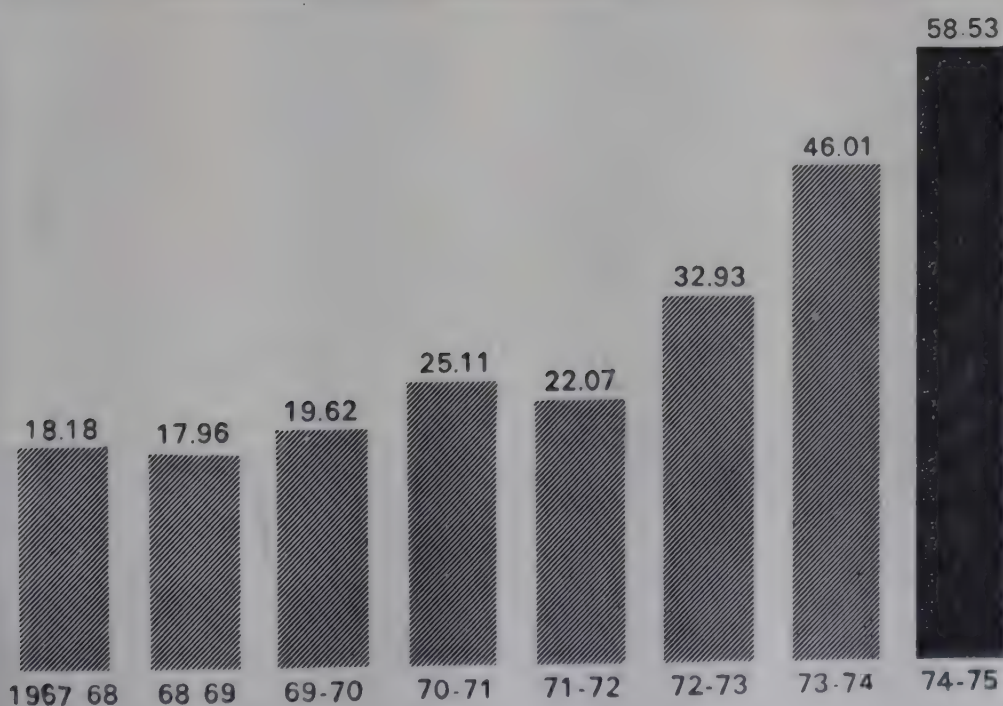
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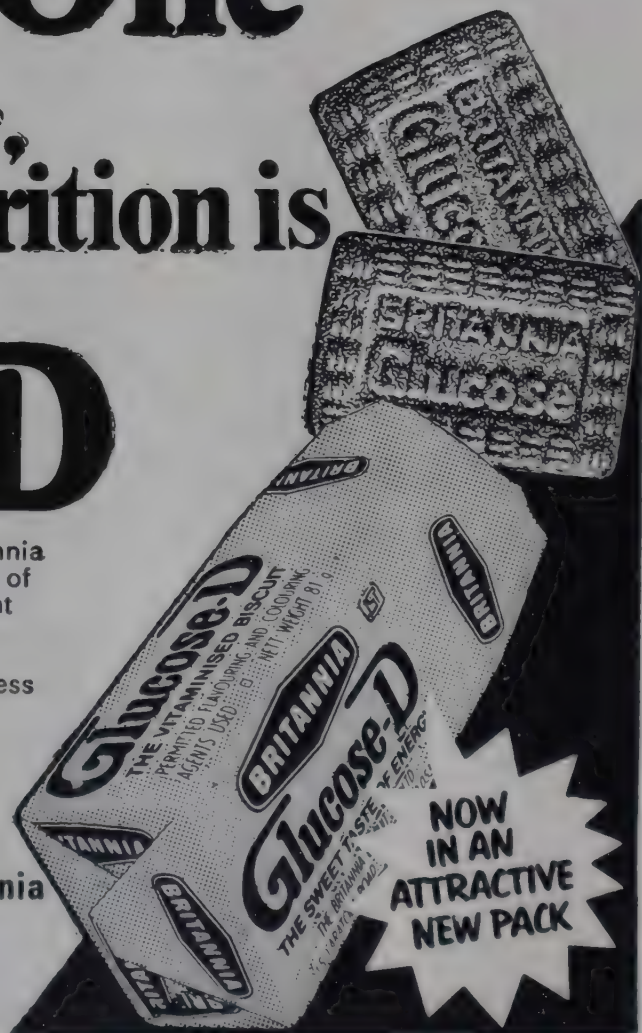
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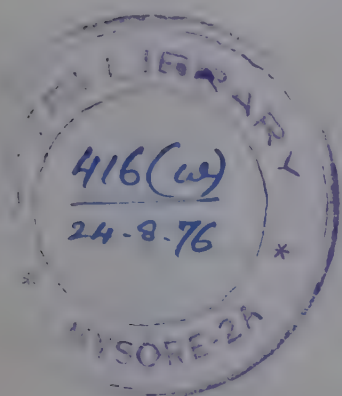
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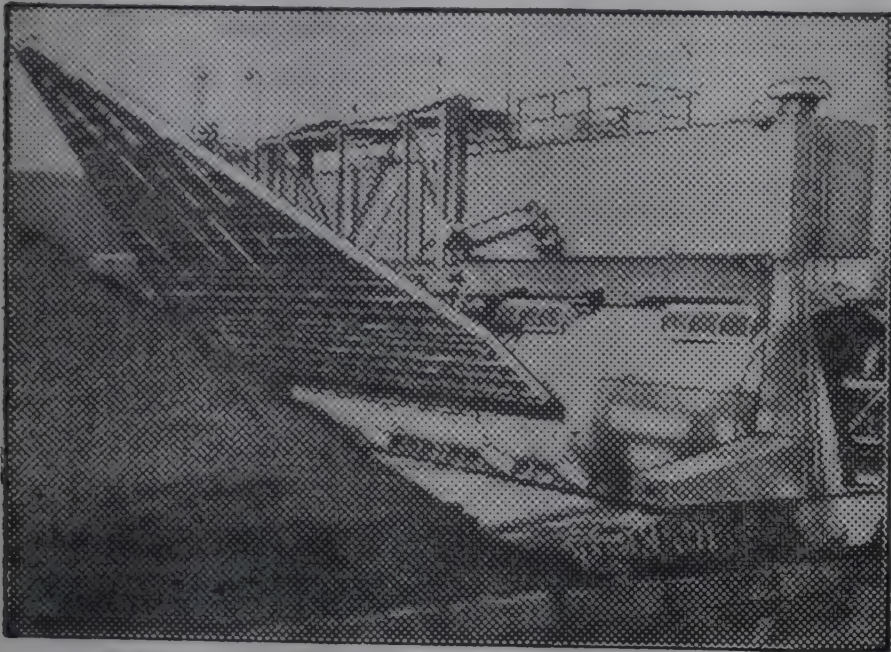
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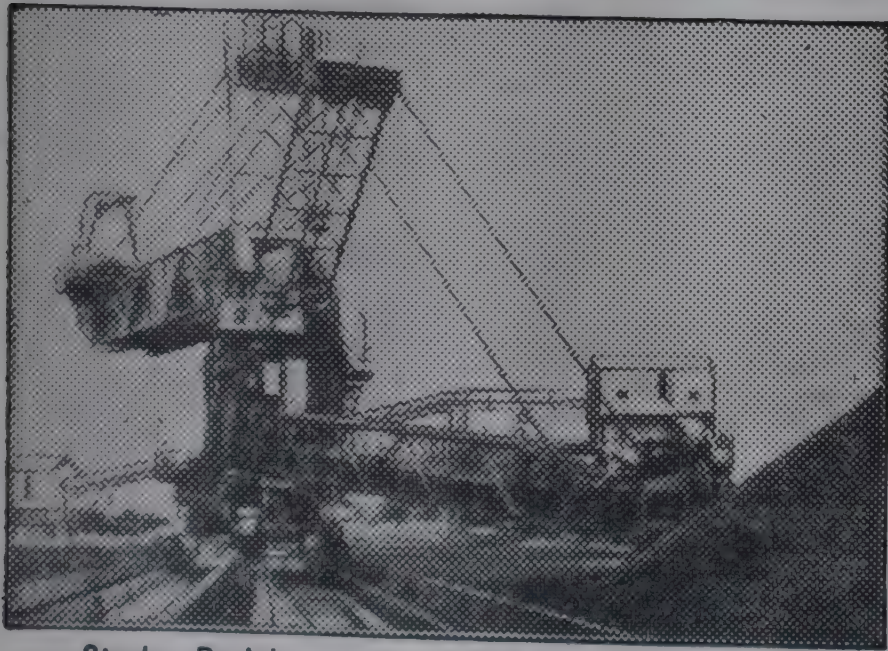
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Planning for water

WATER is the heart of the Indian economy. It is water which sustains or paralyses the economic activity of the country. Will India continue to remain a weak and poor nation? Will the battle of poverty ever be won? Will the exasperating unpredictability of our existence ever be minimised? Will India ever be able to realise her potential as a major power? Answers to these questions will be largely decided by the quality of the management of water which we can display during the next decade. But the continued neglect of this most precious resource by our people and the Government at times induces a sense of pessimism about the self-respecting survival of the Indian nation.

II

It is true that the Government of India did launch ambitious river valley projects soon after independence. The Bhakra dam became the symbol of this concern for water. It is also true that irrigation has generally received high priority in our planning. Under various plans we have spent on major and medium irrigation projects as much as Rs 4,300 crores, which was 9 per cent of the total public sector Plan expenditure. As a result, the area under all types of irrigation increased from 20.9 million hectares in 1950-51 to 31.6 million hectares in 1971-72, the latest year for which the data are available. During the same period, the area under cultivation also increased. The area under irrigation as percentage of the area under cultivation has increased from 18 in 1950-51 to the currently estimated figure of about 25. Despite this achievement, water continues to be the most intractable problem of the Indian economy. This can be seen from the fact that droughts ravage rural India with the same frequency and ferocity as was witnessed during the British days, with the difference that deaths of human beings from mass starvation do not occur now as in the colonial era. But the loss of cattle probably continues to be as colossal as before. Human misery has been mitigated, but the shadows of animal existence are still lengthening.

It would not do to say that we produce some of the most sophisticated engineering goods in the world. We are justifiably proud of it. But without water even the most sophisticated industrial development loses its meaning and relevance. If even after 28 years of independence, India remains the image of a helpless nation with a begging bowl in her hand, this can be explained, *inter alia*, by the fact that our rulers have failed to understand the most strategic role that water plays in making a nation self-reliant in the matter of the basic necessities of life. If we don't have steel or non-ferrous metals, we can survive; if we don't have petrochemicals or other chemicals, we can survive; if we don't have airports, we can survive; if we don't have luxury hotels, we can survive and even if we don't have

automobiles, we can survive. But if we don't have water, we make the life of our people worse than that of animals and such survival is no better than living death. The fact that out of nearly 5.76 lakh villages in India, as many as 1.52 lakh villages have no drinking water facility is a grim indication of the neglect of water by Indian society.

III

How rich is India in respect of this priceless resource? India's average annual rainfall comes to around 50 inches (125 cm). On the face of it, this should be regarded as quite adequate for all purposes. Nevertheless, if in practice we have been suffering year in and year out from severe scarcity of water, it is because of the following three reasons:

(a) The greatest problem of India as of all monsoon regions is that almost the entire annual precipitation is concentrated within some 3 to 4 months of the year. This is in sharp contrast to the conditions prevailing, say, in the United Kingdom where the rainfall is more or less uniformly distributed throughout the entire year. As a result, we have a major problem of storing the torrential waters of the monsoon in such a manner that we can meet our requirement during the remaining 8 months of the year. This has been our problem ever since man first emerged in India; and despite all the technological advances and developmental efforts during recent years this problem has continued to remain unsolved.

(b) Whatever precipitation we get is distributed very unevenly. Thus, on the one hand, Cherrapunji in north-east India has the world record of 428 inches (1,070 cm) in an average year; on the other hand, in Jaisalmer in western Rajasthan the average rainfall in some areas comes to just about 4 inches (10 cm) or so. This ratio is 107:1. This staggering regional imbalance poses some problems even in respect of transfer of water from the surplus areas to the deficit areas. Thus, for example, given the geographical situation of Assam and adjoining regions, it is impossible to bring the water from these regions to other parts of India. Similarly, the torrential rainfall of about 100 to 125 inches (250 to 313 cm) along the 1,600 km coast from Thana in Konkan to Trivandrum district almost entirely goes waste because it all rushes down to the Arabian Sea after traversing a narrow land strip of about 50 to 100 km. So far at least we have not found any solution to the engineering problem of storing these copious waters and diverting them in large quantities to the eastern side of the Sahyadri-Nilgiri range where the bulk of the population of the region lives and suffers all the curses of what the geographers call 'the rain shadow'.

(c) If there are region-to-region variations, there are no less disastrous year-to-year variations also. Vagaries of monsoon are a well-known phenomenon of the Indian sub-continent. As we know, on an average, out of every 6

years, 2 years are generally good, 2 years are just 'so so' and finally there are 2 years of famine in large parts of the country. This has been a cycle of nature which it is not easy to cope with. So, it turns out that despite a theoretical sufficiency, water continues to be scarce in practice with all its economic and human consequences.

IV

These facts were known to us when, soon after independence, we launched our planning in 1951. We also knew that our incredible rural poverty was directly linked with the problem of water and we also knew that the curse of recurring famines was the most basic economic challenge for the planners. It was also generally accepted that this problem was not beyond human solution. In fact, during the British days, we were all unanimous in characterising our famines as man-made phenomena. The implication was that, given modern science and technology, it is certainly within human means to eradicate famine from Indian life despite all the vagaries of nature. This was by no means an ambitious dream. What was primarily required was the political will and organisational framework. If independent India has failed to tackle this basic problem, it is not due to lack of financial resources. It is only the result of our lopsided priorities and unconcern for the avoidable misery of the rural poor.

Our record in defence preparedness is creditable. Our self-sufficiency in military hardware is a matter of pride for us. We can take similar pride in the development of heavy industry. If we had mounted a similar effort in respect of water, India would have been a power which the world would have respected without reservation.

This lack of awareness about the water problem is not found in the Government alone. To be honest, even an economic journal like ours treated it as a peripheral matter. So what is being written here is not the condemnation of the ruling class, but self-introspection of a thinking segment of our society. The fact that we have decided to devote our Annual to this problem is itself an indication of the emerging awareness about this most strategic problem of the Indian economy.

V

There are many reasons why there has been a general neglect of the problem of water. But certainly one of the most important reasons for this is the utter lack of the most relevant data on this problem. On the face of it, such a statement may seem unfair. So let us substantiate our complaint. To begin with, there is not a single regular publication issued by any Central Government agency giving all the basic facts concerning water in India. Such an *Annual Handbook of Water* is very badly required. Let us take another example. For much of our surface water resources, we rely upon our rivers. Here, the elementary question which arises is: How much is the flow of water in each particular basin and what is its time and space pattern?

We need these data for each one of the hundred of our basins and sub-basins. Such data are not available. The Central Government publishes, with a time lapse of some 3 to 4 years, some data on various types of irrigation facilities available in different regions of India. Here, the very definition of the term 'area irrigated' is not free from vagueness. As one can understand, the firm figure that the authorities probably have with them is the capacity of a particular reservoir. But from that, when they derive the figure of the area benefiting from this reservoir two problems arise: (a) the area which can be irrigated by a given quantity of water depends directly on the cropping pattern of a particular region. Unless the assumption about the cropping pattern is made clear and unless that assumption corresponds to the reality on the fields, any figure derived in a hypothetical manner becomes rather meaningless. (b) the usual official parlance, once a waterhead is provided to a certain bloc of cultivated land (say, about 200 hectares), this area is automatically recorded as benefiting from irrigation even though the farmers may not be, for any reason whatsoever, using the water. So the appropriate term for such data should be irrigable area rather than irrigated area. Yet, in the official statistics, no distinction is drawn between these totally different concepts.

To cite one more example, there is the crucial question of hydrological data concerning evapotranspiration in different areas of the country during different months of the year as also the permeability of soils in different parts of the country. Unless these data are available, any planning of water use is impossible. Yet, till now no systematic effort has been undertaken in this country to collect the data on a countrywide scale.

Finally, there is the question of preparing the water balance for each river basin and sub-basin so that we know in quantitative terms the current water use pattern in our country. No such balances for our rivers have yet been prepared. As a result, we do not know how much water today we use for drinking and how much for irrigation and how much for industry. In the absence of such vital data it is impossible to plan for the rational use of this scarce resource of the country. We call this scarce resource basic cause while economic resources like finance, capital equipment, manpower skills can be augmented—or even borrowed—water resources of the country can only be better utilised but can never be expanded.

It is this unawareness of the necessary water data that explains the lack of debate on the rational and equitable use of water. The marginal attention that the planners have paid to efficient utilisation of water is a byproduct of their concern for modernising Indian economy. If water is required, how much of it is required for a steel plant or a fertiliser plant is the question that is asked first rather than how much drinking water will be required for human beings, how much is required for our precious cattle wealth and farms. If these questions had been asked, our Five Year Plans would have been converted into water plans and not plans for such industrial and agricultural growth as would serve the interests of the upper classes of rural and

in India. If planning has become irrelevant to Indian society, the cause for it can be traced to the unawareness of the Planning Commission about the place of water in the Indian economy.

VI

The cycle of water begins with the rainfall and ends with evaporation and flow-back to the sea. The real problem man faces is to make the most efficient use of water when water is on land during the course of this cycle. Whether a nation makes the maximum use of water will thus depend on its ability to delay the flow of water towards the sea or into the atmosphere. This can be done by working in two directions simultaneously. First, if the land is levelled and if extensive contour bunding is undertaken all over the country, it can contribute considerably to the conservation of water in the soil. But in order to do this effectively one has to work in the second direction also, namely, covering the soil with vegetation including fodder crops and forests. One of the most important benefits flowing from the vegetation cover is that the flow of water slows down and as is well known, the slower the flow of water the greater the seepage of water in the sub-soil. It is this groundwater stored in sub-soil and lower levels which makes or mars the economy of a monsoon-fed nation like India.

From this it follows that any strategy for better use of water has to be based on an integrated programme for conservation of land, forests and water. It is important to note that none of these three can be saved singly unless all three of them are conserved. They can be saved all together or none at all.

Further, unless we know the nature and quality of our soil, which is the medium of using water, it would be difficult to formulate an effective water policy. For this, a national soil survey is urgently called for. This survey should have been launched at the time of independence itself. But so far, not much has been done in this direction. Recently, through a special interim report, the National Commission on Agriculture has strongly recommended the establishment of a central soil survey organisation with sufficient financial and technical resources to complete a nation-wide detailed soil survey within a reasonable period.

While planning irrigation projects, it is necessary to ensure prevention of water-logging and salinity. For this purpose, irrigation and drainage should be planned and implemented together in an integrated manner. To irrigate farms without an appropriate drainage system is to invite disaster in the form of water-logging and salination. This can be seen from our sad experience in Punjab, Haryana and some other intensively irrigated areas.

In this context we should be grateful to the World Bank for its insistence that it would not support any irrigation project unless it also covers the total planning of soil-water used in the entire command area. Indian authorities were just not used to this type of comprehensive planning, be-

cause such planning would entail larger financial expenditure and greater organisational responsibility. But since World Bank loans were tied up with such a sensible planning, State Governments have been, of late, compelled to prepare such Command Area Development Plans in States like Gujarat, Madhya Pradesh and Rajasthan. In the process we have started learning many valuable lessons which otherwise we would have tended to ignore. We would suggest that the Central Government also should insist on the same condition whenever it sanctions funds for any irrigation projects submitted by State Governments. A similar approach should be adopted by State Governments when they finance district level irrigation projects. Such an approach would ensure the maximum utilisation of water resources and help achieve the intended ultimate results in terms of production and human welfare.

VII

In the formulation of any strategy for water during the next decade the following should provide the framework:

1. That nearly three-fourths of our people are not provided with a basic necessity like adequate potable drinking water facility is a matter of grave national concern. This is the most glaring failure of our Five Year Plans. If we have no resources for such a basic need as drinking water, then something is fundamentally wrong in our sense of priorities. We would, therefore, suggest that the task of providing drinking water should be entrusted to the Defence Ministry and our armed forces should help in establishing this basic facility not only during normal times but also during droughts and famines. A time-limit of two years is sufficient for creating drinking water facilities for our villages if the armed forces take up the work, with the fullest co-operation of civilian authorities. A country which has to spare more than Rs 2,000 crores for defence should certainly use its defence personnel for creating this most basic amenity for the people. Once the drinking water facility is fully operational in an area, the armed forces could hand over the facility to civil authorities and withdraw from that area. They may thereafter be expected to re-enter the scene only during droughts and famines, as they have been doing at the time of floods. Incidentally, if the armed forces help in this historic task, the productivity of our people would increase to such an extent that the very increase in their production would be able to take care of nearly 50 per cent of the defence burden.

2. One-fourth of the outlay of the Central and State Governments on health should be earmarked for drinking water projects, because provision of potable drinking water is the most effective method of prevention of water-borne diseases which play havoc in our rural areas.

3. For the next five years there should be a ban on undertaking gigantic irrigation works. In respect of on-going works, funds should be released by the Central Government only after the respective State Governments implement a specified quantitative target of utilisation of

the irrigation potential already created. That a country like India should over-concentrate on major dams was itself an initial mistake. But once such a mistake has been committed, it is necessary that we should try to make the maximum use of the capacity created. Today, for instance, nearly 40 per cent of water is being wasted in field channels because they are not lined and covered.

4. Because of organisational failures, the problem of adequate field channels and contour bunding as well as drainage facilities is not simultaneously tackled. As a result that water instead of becoming a boon becomes a curse inasmuch as this leads to utter ruination of good soil through water-logging and salination. The money value of this loss runs into tens of crores or perhaps even hundreds of crores of rupees every year.

5. For the next five years, all financial and organisational resources of irrigation departments should be committed to creating minor irrigation projects for better utilisation of groundwater resources rather than storage in huge reservoirs. Several advantages of groundwater have been already stressed by experts. Thus, for example, the greatest advantage of groundwater is that you store it in the excellent storage tank created by nature itself, namely, the soil. This storage does not cost a single rupee either for construction or for maintenance, nor does it create any danger of siltation or evaporation losses. Nor are there any losses in the course of transit of water from the point of storage to the point of use. And, of course, from the point of view of the farmer the greatest advantage is that he has full command over water. Only a farmer who has suffered the vagaries of canal irrigation systems can appreciate the enormous advantage of water which is available at the push of a button whenever and in whatever quantities he wants. Whatever may be one's views about the political philosophy of Mao Tse-tung, the fact remains that China under his leadership has shown to the Third World how to make incredible use of water resources by undertaking small projects and build them by sheer manual labour during the off-season.

6. All over the country, every farmer should be induced to dig a tank in his own field, so that even in times of drought, depending on his own tank water, he can save himself and his cattle from the worst impact of drought. Fortunately construction of such tanks would not put any big financial burden on the farmer. He and his family can dig it during the off-season months.

7. A National Water Commission under the chairmanship of the Prime Minister should be established as an apex organisation to implement a water policy based on following priorities: Water should be available first for human beings, then for cattle, then for farms, then for power and lastly for industry. State Water Commissions and similar District Water Boards should be set up to implement this policy at grassroots levels.

8. The poor farmer should have the first claim on water resources; and while doing so, the seemingly sensible suggestion of "productivity first" should be ruthlessly ignored.

In order to implement this basic principle of equity, it would be necessary to treat all water resources as social property and not as private property to be enjoyed by any particular family. Necessary legislative steps should be taken and an organisation should be set up in order to see that private property in water resources is gradually eliminated throughout the country during the next five years.

9. In every district of India, a water-land-forest arm of voluntary workers should be created and the local MLAs and MPs should lead the workers in this national task of voluntary labour.

10. The land development banks in future should solely concern themselves with the work of soil and water conservation projects.

11. Nationalised banks should earmark 20 per cent of their new credit for water-soil-forest conservation projects.

12. Textbooks at all levels of education—from the primary to college level—should contain lessons on water-soil-forest conservation. Class-room teaching should be supplemented by compulsory practical work in nearby areas. This is necessary because children must know that these are the basic issues which would make or mar their future existence. Mass media in private and public sectors should also join in a campaign to educate the whole nation in this subject.

13. To ensure that these ideas are fully implemented, every district of India should be allocated to a State Minister. The Minister should be asked to implement water-soil-forest conservation programmes in the district allocated to him on the basis of the previously prepared annual plan. Every State Minister should be expected to spend at least a week every month in the district assigned to him. Whether he should be allowed to continue as Minister or whether he should be given a party ticket for the next assembly elections should be decided on the basis of his performance in respect of this programme. All Chief Ministers should report once every quarter to the Prime Minister on what is being done in this respect at the district level, and the Prime Minister should make an annual report to the nation through Parliament.

VIII

If we as a people are serious and self-respecting enough to tackle the problem of food and hunger in the foreseeable future, we have no alternative but to pay all possible attention to the management of water, soil and forest. We took these basic natural resources for granted and used them with an indifference which has led to the ruination of our economy. This may appear a harsh assessment to only those who want to drive out from their memory the Other India where the majority of the people eke out an existence which is worse than the animal existence. So from the point of view of self-reliance, national self-respect and social justice, the question of water has to be recognised as the central issue of the Indian economy. It is said that in Indian economy nothing moves unless agriculture moves. Agriculture cannot move unless water moves.

Vadilal Dagli

WATER FOR TOMORROW

By Y. K. Murthy

THE three important natural resources of India are her people, her land, and her water. Of all the natural sources upon which human communities depend, none is required for such multiplicity of purposes as water.

Covering a geographical area of 25 million sq miles (3.27 million sq km), India is the seventh largest country in the world. In population, India ranks second in the world, touching the colossal figure of nearly 600 million. The average annual precipitation in the country is about 100 cms and the average annual runoff is estimated at about 700 km³.

Physiographically the country can be divided into four regions:

- (i) The great mountain zones of the Himalayas in the north;
- (ii) The Indo-Gangetic plains, to the south of the Himalayas, a vast stretch of flat and fertile alluvium. This belt is about 2,400 km (1,500 miles) long and 250-300 km (156-188 miles) wide.
- (iii) The southern peninsula or the Deccan Plateau, which is walled by the western and eastern ghats and rimmed by strips of coastal plains.
- (iv) The arid Thar desert in the Rajasthan region.

Rainfall: Although the average precipitation over the country as a whole is about 1,000 mm, this is very unevenly distributed in space and time. The west coast and the Assam regions are areas of heavy rainfall, receiving 2,500 mm (100 inches) and above annually. The eastern part of the peninsula and the northern plains receive moderate rainfall of 1,000-2,500 mm (40-100 inches) annually. The Punjab plains and upper western parts of the Deccan plateau are areas of low rainfall (250-1,000 mm, i.e., 10-40 inches annually); while the Rajasthan desert and Ladakh plateau of Jammu and Kashmir are regions of very low precipitation (less than 250 mm, i.e., 10 inches). The bulk of the rainfall occurs in the south-west monsoon period covering 4-5 months of June-October. A large part of the country experiences acute water shortage in the

other months. It is only the south-eastern coast of peninsular India that receives the major share of the precipitation in November and December from the north-east monsoons.

River systems: From considerations of size, the rivers in India can be classified under three categories, viz:

- (i) Major rivers having a catchment area of over 20,000 sq km each. There are 14 such basins.
- (ii) Medium rivers having a catchment area of 2,000-20,000 sq km each. About 44 rivers fall in this category.
- (iii) Minor ones with a catchment area of less than 2,000 sq km each. There are a large number of such rivers.

Of these, the rivers under major and medium classes contribute nearly 90 per cent of the total runoff of the country's river systems.

Going by the pattern of flows, the river systems of the country can be divided into two distinct types viz:

- (i) The perennial rivers of the Himalayan region, which are snow-fed and consequently carry appreciable flows throughout the year; and
- (ii) Rivers of the peninsular India, which derive their flows entirely on rainfall and are consequently seasonal in nature. These rivers carry enormous flows during the monsoon period of June-October, which is the time when the bulk of the rainfall is concentrated and thereafter the flows dwindle down to a mere trickle in the dry weather period.

Despite this difference, all these rivers have one common feature in that they carry enormous volumes of water during the monsoon period.

Assessment of the country's water resources: The water resources of India can be primarily classified under two heads, viz: (a) Surface water resources; and (b) Ground water resources.

(a) **Surface water resources:** While collection, compilation and publication of statistics relating to the land and the people have been done in a comprehensive manner, due attention has not unfortunately been given to the collection of data in respect of our water resources. It was only in

1945, when the Central Water and Power Commission was set up, that some thought was given to the assessment of the country's water resources. As a rough estimate, the annual rainfall over the whole country would be equivalent to about 3,700 billion cubic metres (3,000 million acre feet) of water. Of this, around 1,250 billion cubic metres (1,000 million acre feet) is lost by evapo-transpiration, and another 790 billion cubic metres (650 million acre feet) by seepage into the soil, thus leaving 1,660 billion cubic metres (1,350 million acre feet) as surface flow into the river systems. However, all this flow cannot be utilised because of numerous limitations imposed by topography, climate, soil conditions, etc. It has been estimated that only about 666 billion cubic metres (540 million acre feet) of water can be utilised from various river systems without large inter-basin water transfers. Moreover, because of the uneven distribution of rainfall over the year, it becomes necessary to store up the flows in the monsoon period for regulated releases during the non-monsoon months. To make use of the whole of the utilisable flows of the country's rivers, therefore, substantial storage—about a third of this amount—might be called for.

So far our assessment of the water resources in the various river systems has not been very systematic; it has been rather sporadic. Although a beginning had been made in India on the collection of basic rainfall data in the latter half of the last century, no worthwhile work has been done in measurement of river flow. Most of the gauge and discharge observations made in the past years have been undertaken in connection with existing or proposed projects for irrigation, hydro-electric power etc. There was no attempt, until a few years ago to make gauge and discharge observations aimed at a study of the water resources of a river system as a whole. It was only around 1960 that the Central Government took up work on setting up gauging stations on the major rivers and their tributaries according to international standards and on modern lines, with a view to enabling collection of accurate and reliable data of river

Mr Murthy is Chairman, Central Water Commission.

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ws in the whole country for a scientific study of the surface water potential of the nation.

(b) *Ground water resources:* The position is no better with regard to the assessment of ground water resources as well. Rough estimates are that out of about 790 billion cubic metres (650 million acre feet) of water that seeps into the soil, about 430 billion cubic metres (350 million acre feet) remains in the top layers and produces soil moisture which is essential for the growth of vegetation. The remaining 370 billion cubic metres (300 million acre feet) percolates into the porous strata and represents the actual enrichment of underground water. It is estimated that, out of this, the water that can be extracted economically is only about 255 billion cubic metres (200 million acre feet). The ground water resources are mainly in the Indo-Gangetic plains of Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal. It is only recently, since about 1955, that the Central Government has undertaken a systematic nation-wide assessment and exploration of ground water potentialities.

Utilisation and projected demand of water: In India, we have already many projects which harness the river flows for development of irrigation, power, drinking water supplies, industrial uses, pisciculture, recreation, salinity control, navigation, etc.

A. Irrigation: The single largest withdrawal user of water resources in India is agriculture and irrigation. Upto 1951, when the first five year plan was launched, only 17 per cent of the utilisable annual flow was being used. With this utilisation, the area irrigated was 22 million hectares (50 million acres). During the course of the four five year plans, the utilisation has gradually increased to about 250 billion cubic metres (200 million acre feet) i.e. 45 per cent of the utilisable water resources. About 12.5 billion cubic metres (10 million acre feet) of ground water has also been exploited for use in irrigation.

B. Hydro-electric power: Another very important field in the utilisation of water is the development of hydro-power. It may, however, be mentioned that this is mostly only of a flow use of water and, except in cases involving trans-basin diversion in the case of hydro-electric power generation, the flow, after, generating power, returns to the river itself, i.e. is utilised in the water course itself, and is again available for further withdrawal uses like irrigation or water supply lower down the river.

C. Domestic and livestock consumption: The problem of supply of drinking water is important for any country. In India this assumes special significance because of its vast rural population flung apart in isolated and scattered villages numbering nearly 6 lakhs. Most of the villages used to depend on wells for their water needs. In nearly a third of the villages, the wells are either inadequate or they go dry in summer and thus fail just at the time of the greatest need. Sanitary arrangements are quite poor in many urban areas. In the field of potable water and arrangements for sewage disposal, our country has to go a long way. It is roughly estimated that the utilisation of water for drinking water supplies is about 10 million acre feet.

D. Industries: With the rapid growth in industries all over the country, the availability of adequate water supplies for industries has been assuming more and more importance. Approximate estimates are that the utilisation for industries amounts to about 2 million acre feet.

E. Cooling water for power stations: Large quantities of water are required in thermal power stations for cooling purposes. It is estimated that the total requirement of water for cooling purposes in the thermal stations and atomic power plants is about 7-8 million acre feet.

F. Other uses: In addition to the main uses dealt with above, water has been exploited for other purposes also such as pisciculture, pollution control, wildlife preservation, recreation, navigation, mining, etc. However, the actual quantity of water that goes to serve these needs is but a small fraction when compared with major uses like irrigation. Moreover there are no accurate estimates of these quantities.

Taking all these uses, the total water utilised at present is about 330 billion cubic metres (270 million acre feet). With the current increasing emphasis on irrigation development, the rate of increase will be still higher in the coming years. With the rapid economic and technological developments now taking place in different spheres in India, the demands for water for secondary needs are also fast increasing. Steady increase in demand for water has come as much from the proliferation of purposes for which it is required as from sheer population growth. It is obvious that by the turn of the century, a critical stage would thus be reached when we would have exhausted all the

utilisable water resources in the country and would be facing a crisis of water for our needs.

Suggested solutions: Water is fast becoming a scarce resource in India. In some southern basins like the Cauvery, a very high proportion of the available water has already been tapped for development of irrigation, power etc. Many other basins would reach this stage within a short time. Nearly one third of the geographical area of the country is subject to droughts, causing serious water scarcity. Already there is an awareness that the volume of demand has fast approached the threshold beyond which it can no longer be safely assumed that natural supplies are infinite. This situation necessitates planning and management of the total water resources system. In other words, we should no longer be thinking solely in terms of how much we require for one purpose or the other, but rather in terms of how best we can make the most efficient and optimum use of what little water we are still left with. Since most of the good sites for construction of storage reservoirs have already been exploited, further development is becoming more and more costly and difficult. Countries all over the world have started realising the gravity of the situation; and regions which in the past were known for their rich resources are now joining the ranks of the most vociferous claimers for more water. Measures to minimise wastage of water, e.g. by adoption of sprinkler irrigation and trickler irrigation and maximisation of the benefits for irrigation, have to be thought of. The quest for new sources of water has commenced. Highly sophisticated technology for discovering new sources of ground water in the region where one had never expected the possibility of finding water has now become a reality. Attempts are made in many parts of the world to create artificial rain by various means. Technical and economic solution to the problem of desalination of sea water is still in an infant stage.

While countries are thus frantically striving on the one hand to strike a balance between the supply and demand of water, a grave menace is threatening on the other hand to shake our concepts of equilibrium. This is the pollution of our water resources caused by improper sewage disposal and the numerous new ventures that are taking place in fields like industrialisation. The rate of pollution is likely to nullify all our endeavours aimed at the development of new

sources for water. It is, therefore, very important to guard against pollution hazards. In developed countries, which have only meagre water resources at their disposal, this crisis has already taken place. In countries like India, rich in water resources but still only in the developing stage, the problem of pollution has not yet taken such a serious proportion. We still have some time to act; and the sooner we effectively deal with this the easier it will be for the country to ward off the calamity and put the available water to the best possible uses.

The subject of systems approach in water resources planning has assumed great importance in the present day world. In the countries where there is scarcity of water, this science has developed to a great extent. Experiments are being made in various sectors of water utilisation to limit the use of water. New methods to conserve

water and use it more economically are being developed. Our future water resources planning will have to encompass all social needs of the nation. The theory of integrated water resources management is now relatively well developed and a great amount of work in this field is at present being carried on by a number of scientific institutions. But actual application of such management policies is still relatively rare and, in the developing countries, it is still in its infancy. However, attempts have been made recently in the field of regional and sectoral planning in our country in this regard.

Central Water Commission

The administration and management of our water resources is another important aspect that needs some rethinking. India is a Union of States. The development of water resources for irrigation is mainly the concern of

the States. Thus, investigation, planning, construction and operation of irrigation works are largely with the Irrigation or Public Works Department of the concerned State Government. The planning and development of hydro-power is generally with the State Electricity Boards. The Central Government has the responsibility for co-ordinating development and regulation of inter-State rivers and, in general, assist, examine and finance the irrigation and power projects sent by the States. The State Governments plan development projects within their territorial and legal limitations. The Ministry of Agriculture and Irrigation of which the Central Water Commission forms the highest technical authority, co-ordinates and handles development of irrigation (major and medium) projects for the entire country. This Commission has also specialised expertise for designs, research, investigations and planning of any type of river valley projects. The Commission has also been conducting river gaugings on a number of important and inter-State rivers in the country. Though irrigation is essentially a State subject, any major or medium project has to be first scrutinised by the Central Water Commission to ensure that the proposal is technically sound, economically viable and that it does not interfere with the interest of any neighbouring States.

As water uses are getting diversified, and with the growing realisation that water is fast becoming a scarce resource in the country, new problems are bound to rise in its control, management and administration. At present there is no single agency responsible for the overall development of water resources for different purposes such as irrigation, power, drinking water supply, industrial uses, etc. This has happened because over 90 per cent of the water use in the country has so far been for irrigation alone. With the increasing trends in urbanisation and industrialisation, use of water for benefits other than those of irrigation is bound to increase very rapidly. This would call for a single agency like the Central Water Commission, which will have the overall responsibility for the optimum and most beneficial development of the water resources for various uses. The Central Government might have to treat water resources as a national asset, and assume full responsibility for the assessment and development of water resources.

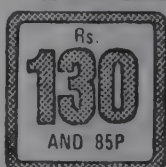
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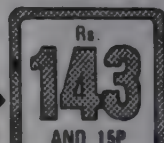


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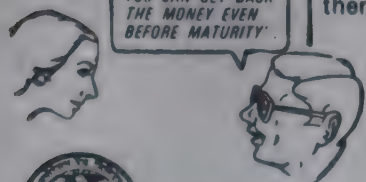
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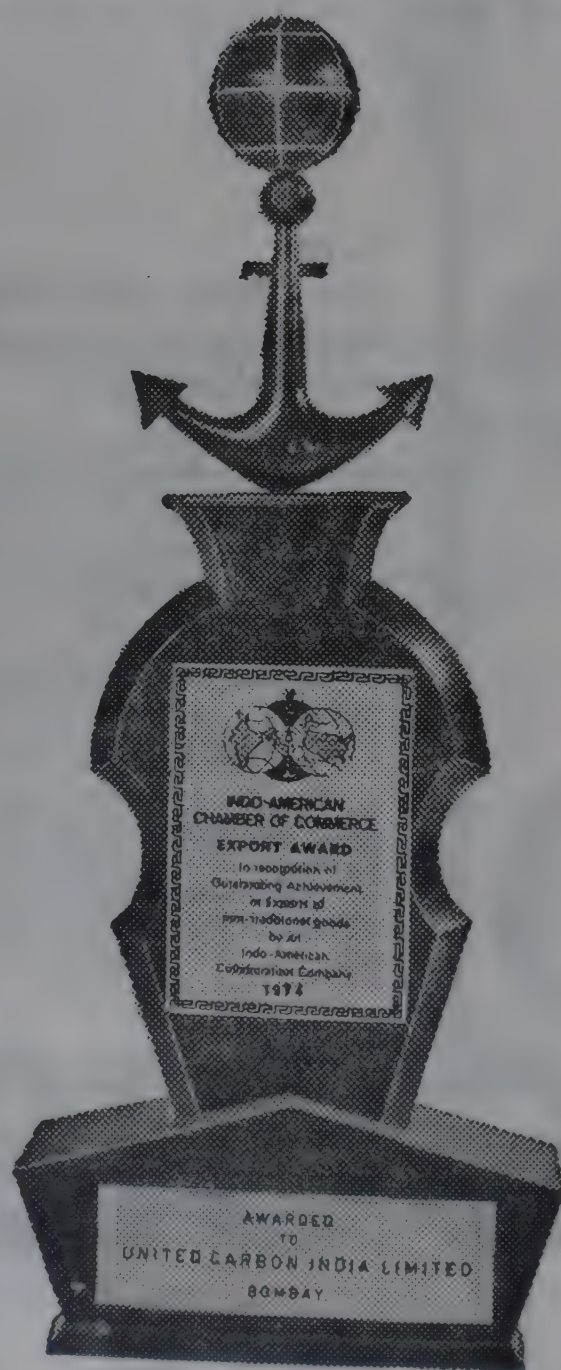
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Water in India's future

By M. C. Chaturvedi

NOTHING, except air, is more vital for life—plant, animal, or human—than water. For instance, the human body is 65 per cent water and every day one must replace 5 per cent of it. For the production of 1 kg of wheat, steel, or synthetic fibre about 500, 250, or 20,000 kg of water, respectively are required. The uses of water in human life are varied. Thus, water is a vital source of energy and provides important means of inland or ocean-borne

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transportation as well. It is essential not only for the sustenance of human life and activities but for the quality of life as well. The oceans, rivers, lakes, etc enrich the environment, and the quality of water, in a large measure, reflects the quality of the environment.

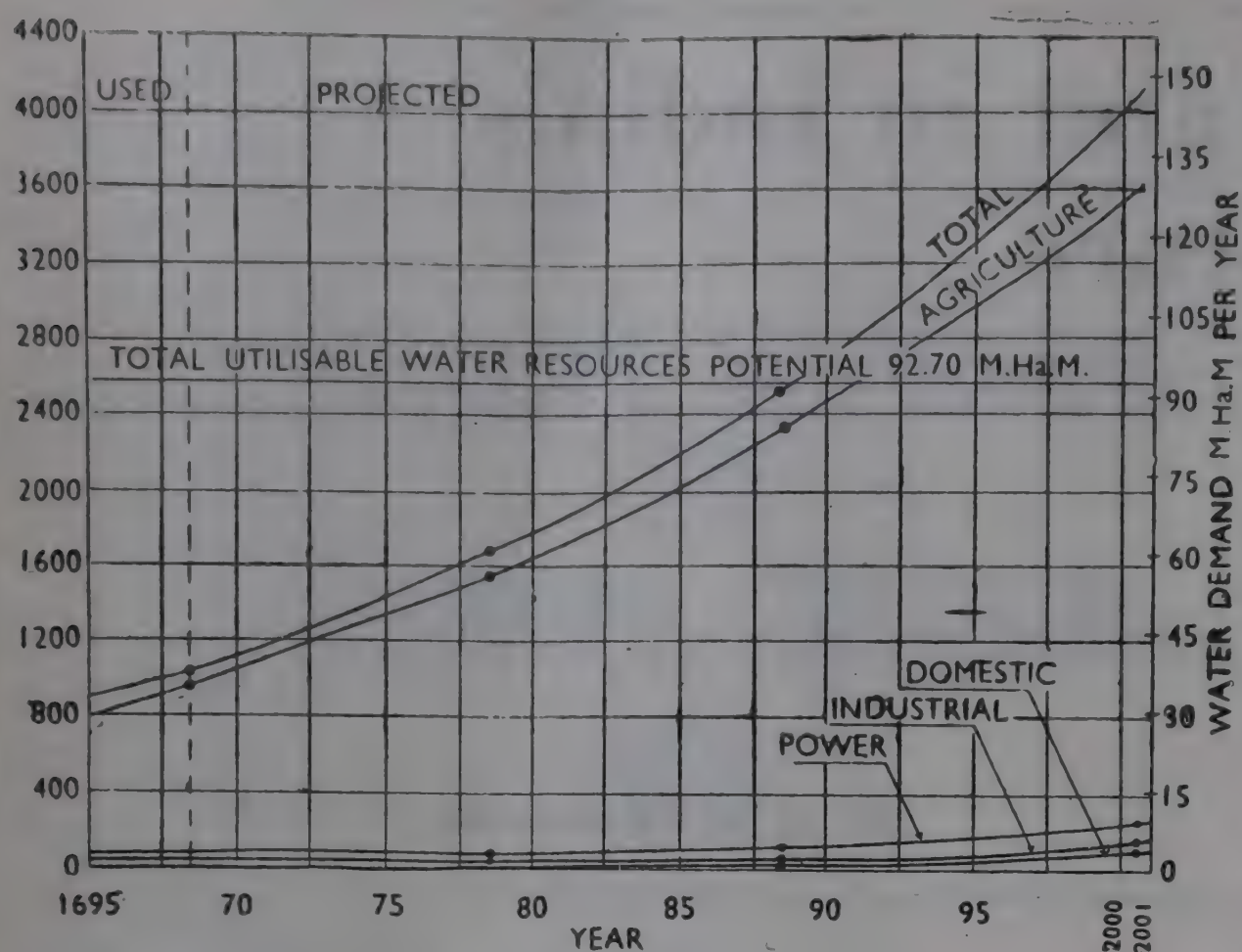
Although water is available on a regional basis in adequate amount in India, the spatial and temporal imbalance is severe. Most of the rainfall, about 80-90 per cent, is concentrated in four monsoon months. While the north-eastern parts represent world's wettest areas, the large central-western region is a chronic drought area.

In view of the climatic conditions and the agrarian economy, attempts have been made in India since prehistoric times to store water in dams and to carry it to distant parts by canals. In the modern world and since independence utmost importance has been given to water resources development. But the fact that water is a limited, though a renewable resource, poses a serious problem as the demand on it grows with the needs of the exploding population and economic development. For instance by the end of the Fourth Five-year Plan in 1973-74, a total of 50 per cent of the estimated available resources had

Table I : Estimated water use and projected requirements (billion litres/day)

Type of use		Withdrawal					Consumptive use				
		Used	Projected				Used	Projected			
		1968-69	1973-74	1978-79	1988-89	2000-01	1968-69	1973-74	1978-79	1988-89	2000-01
Domestic	Rural	13.68	18.45	22.90	32.10	45.00	9.58	12.70	16.00	22.40	31.50
	Urban	11.30	15.75	19.88	28.40	40.00	3.42	4.72	5.95	8.50	12.00
Industrial		73.00	12.30	18.90	47.20	151.00	0.60	0.99	1.49	3.58	11.58
Steam electric power		19.05	34.50	52.30	88.00	237.80	19.05	34.50	47.50	71.50	148.00
Agriculture	Irrigation	965.00	1239.00	1590.00	2350.00	3600.00	580.00	743.00	955.00	1410.00	2160.00
	Live stock	12.60	13.15	14.25	17.00	19.20	11.35	11.85	12.85	15.30	17.30
	Total	1028.93	1333.15	1718.23	2562.70	4093.00	624.00	807.76	1038.79	1531.20	2380.38
Total as per cent of the ultimate utilisable		40.50	52.60	62.80	101.00	161.00	24.60	31.90	41.00	60.50	94.00

FIG.1. NATIONAL WATER DEMAND.



been committed, yet an apology of irrigation to only 26 per cent of the land and barely tolerable drinking facilities to 10 per cent of the population had been provided. Even this has been at the cost of serious environmental damage. Diversion and damming of rivers have laid large lengths of natural flowing rivers waterless, denying even normal water availability to population

centres which had grown around it only to waterlog large areas elsewhere.

Projections of future water demands raise serious problems. Future projections are uncertain as they involve estimates of population growth, economic activity level in various sectors and related use rates, water use efficiencies, etc, but taking these as best as possi-

ble, an estimate of water use and projected requirements has been made in Table 1 and fig 1 (1). These are subsequently stated projections are based on the official population estimates and rates of economic growth(2). There are, a population of 87 crores by March 2000 (out of which 21 crore will be urban) and growth rate of 5 per cent upto 1983-84, 6.0 per cent upto 1990-91 and 7.0 per cent thereafter. These are optimistic rates on the basis of past performance.

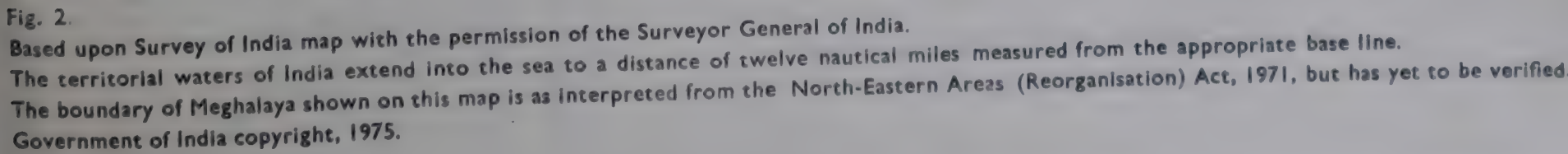
Water use is considered in two categories—withdrawal uses that remove water from its natural courses and consumptive part of it. The demands have been estimated under domestic, industrial, steam electric power and agriculture. There are in addition to instream uses, like hydroelectric, navigation and recreation, but these do not alter the resource availability.

Several issues are strikingly evident. One is the fact that the largest uses are in agriculture. In 1968 agriculture accounted for 94 per cent of the withdrawal uses and even by 2000 AD it will account for 89 per cent of the total withdrawals. Secondly, well before the turn of the century, on the current estimates of water availability and use, even with the withdrawal of all available water resources, these will be seriously short of agricultural demands. In other words, even after committing all the estimated utilisable resources, only 50 per cent of the land could be provided with an apology of irrigation.

Table 2 : Water, land and population statistics of Indian river basins

Sl. No.	River basin	Water resources (Million-cubic-metres)					Population			Land			Per unit resource availability			Resources developed	
		Potential		Utilized			Total (millions)	Density/km ²	% Rural population	Culturable (1000Ha)	Net irrigated (1000 Ha)	Cropping intensity	Cult. land per capita (9/6) (Ha)	Water resou- rce per capita (1/6) (m ³)	Water resou- rce/cult. land (13/12) (m)	% gross water resource (5/1)	% cult. area irrigated (10/9)
		Surface runoff	Ground- water	Surface runoff	Ground- water	Total											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Indus	76907	11109	46048	8515	54563	24.63	77	68.7	9638	3302	1.436	0.3913	3122.5	0.792	71.0	34.3
2	Ganga	509760	82698	13421	40955	173376	221.19	457	91.8	60161	11356	1.160	0.2720	2304.6	0.848	34.0	18.9
3	Brahmaputra	499914	20803	6058	220	6278	17.65	94	91.1	12146	691	1.000	0.6880	28323.7	4.132	1.3	5.7
4	Luni and river of Saurashtra and Kutch	12278	4937	3812	8389	12201	21.82	68	74.5	23447	1093	1.112	1.0749	562.7	0.052	99.4	4.7
5	Sabarmathi	3663	2467	1470	1826	3296	4.77	220	81.3	1548	216	1.041	0.3245	768.0	0.237	90.0	14.0
6	Mahi	7702	2467	3830	1083	4913	5.03	144	86.1	2210	135	1.100	0.4413	1531.1	0.450	63.8	6.1
7	Narmada	44331	4937	2786	1372	4158	10.60	107	81.0	5901	202	1.060	0.5095	4182.2	0.821	9.4	3.4
8	Tapi	17982	5184	5383	1545	6928	8.75	134	78.3	4417	178	1.320	0.5037	2055.1	0.408	37.7	4.0
9	East flowing																
	North of Godavari	32024	5184	11756	299	12055	15.37	203	85.8	4603	840	1.196	0.2994	2083.5	0.692	38.8	18.2
10	Brahmani Baitarni	27363	5184	4320	136	4456	7.77	150	88.4	3201	310	1.442	0.4120	3058.3	0.744	18.8	9.7
11	Mahanadi	66644	12343	21287	277	21564	17.80	126	90.0	7994	1044	1.228	0.4474	3744.0	0.837	32.4	13.1
12	Godavari	117997	14194	32732	5389	38121	35.46	113	85.5	18931	1618	1.240	0.5336	3327.6	0.624	32.3	8.5
13	Krishna	62784	9628	52437	6513	58950	38.50	149	80.9	20299	1819	1.160	0.5275	1630.8	0.312	93.9	9.0
14	Pennar	6858	2374	5031	1390	6421	6.78	123	78.0	3551	358	1.327	0.5238	1011.0	0.194	93.65	10.08
15	Cauveri	18601	5801	17930	2557	20487	21.60	246	78.0	5797	1255	1.247	0.2684	861.1	0.321	110.1	21.7
16	West flowing	217894	13577	13467	N.A.	13467	40.55	362	76.6	6279	661	1.325	0.1548	5373.4	3.460	6.2	10.5

NOTE : The data in Col. 1 to Col. 11, except col. 2 are taken from Irrigation Commission Report 1972. The derived data in Col. 12 to Col. 16 are also on basic data from the Commission Report. The Groundwater data (Col. 2) are estimated basin-wise from State-wise data available in the Commission Report. It has not been accounted in total resource availability.



the environmental implications of withdrawing all available surface flows, using them and returning the increasingly polluted waters to dry river channels are beyond comprehension.

The figures in Table 1 and fig 1 are cross national figures. At the regional level, Statewise and riverbasinwise, more disaggregated position and salient statistics are given in fig 2, and Table 2. The position emerges to be bleak almost all over the country.

Several important aspects may further be pointed out. Water requirement for drinking and sanitary purposes is not large but it is extremely important from health, convenience and efficiency point of view. In view of growing population and widely spread rural population, a colossal effort will be required to supply these basic needs. According to the present estimate even by the turn of the century, only 70 per cent of rural population will be provided with rudimentary drinking water facilities and even 50 per cent of urban population will not be provided with sanitary facilities.

India is poorly endowed with oil resources and the coal resources are moderate, but hydroelectric resources are quite rich and comparatively inexpensive. In 1970-71, hydroelectricity

accounted for 43.3 per cent out of the installed capacity of 14,709 mw. By 2000-1, it is still expected to account for 37 per cent of the 1,62,000 mw anticipated capacity (*). Availability of electricity is crucial for economic growth, yet the past performance has been poor. Immediate and concerted efforts are required for the development of hydroelectricity if our electric power needs are to be adequately met.

Another aspect of water resources development is the control of the extreme events—floods and droughts. Flood ravages continue to be severe and extensive as experience of Patna flooding in 1975 monsoon reminds us. On the other hand 16 per cent of cultivated area is chronically drought affected⁵.

The central issue is that water and related land resources constitute a complex physical-socio-economic-ecological system which responds to and crucially affects the action and course of man and nature. The challenge to develop water resources adequately is critical in India. Three central issues emerge. One, long-term comprehensive developmental planning is required. Yet it is singularly absent. Developments have been carried on a project-by-project *ad hoc* approach which is not only wasteful but harmful. We have been, as the say-

ing goes, attempting to dig wells while feeling thirsty. Secondly, suitable organisations, institutions and technological capability are required. Here too, we are deficient. There is no other field of technology, where the proportion of engineers beyond the first degree or investment on research is lower.

And finally, the third point. According to the present technology of extensive irrigation through low-season diversion canals, we are doomed, both in terms of inadequacy of resources and environmental damage. Yet this need not be so. The present technology, and current estimate of available resources do not take into account storage of monsoon flows through artificial groundwater recharge. If this could be possible, the resource problem as well as the environmental problem could be simultaneously solved as the currently estimated non-utilisable monsoon run-off is almost twice the currently estimated utilisable flows. Recent research has proved the feasibility of economic artificial groundwater recharge on these large scales and suitable techniques for this complex analysis have been developed (*). Instead of the *ad hoc* technological policy, scientific policy and systems planning approach has also been developed (7,8,9).

To conclude, water resources development is crucial for India, but in view of the rapid population growth, colonial background of institutions and approach and current inadequate technological capability, the scene and prospects are bleak. However, this need not be so if immediate and dynamic action is taken. What is needed is a revolution in our approach, technology, institutions and organisations.

References

1. Chaturvedi, M. C., 'Water in Second India', Macmillan, New Delhi, 1976.
2. Fifth Five Year Plan, Government of India, 1973.
3. Report of the Fuel Policy Committee, Government of India, 1974.
4. Parikh, K. S., 'Second India and Energy', Macmillan, New Delhi, (in press).
5. Report of the Irrigation Commission, Government of India, 1972.
6. Chaturvedi, M. C., R. Revelle, and V. K. Srivastava, 'Ganges Water Machine—II'. Second World Congress, International Water Resources Association, New Delhi, Dec., 1975.
7. Chaturvedi, M. C., 'Scientific Policy of Water Resources Development', unpublished.
8. Chaturvedi, M. C., 'Ganges Water Resources Systems Analysis', International Federation of Operations Research Society, Japan, July 1974.
9. Chaturvedi, M. C., and P. Rogers, 'Large Scale Water Resources Systems Planning with Reference to Ganges Basin', Second World Congress, International Water Resources Association, New Delhi, December, 1975.

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UNCERTAINTIES involved in long-range planning are well known. Variables determining the outcome of a development process are large in number, and many of them cannot be controlled to our choice. Sometimes their behaviour in time cannot be predicted on a realistic basis. When a statistical model is available, there are not enough data to feed the models. However, duly acknowledging the fact that the future will take its own course which is beyond the available means of prediction, we can, no doubt, prognosticate, with whatever data we have, the shape of the things to come in the not-too-distant future. This would help to evolve policy measures to control certain activities so that we can remove the possible constraints or bypass the problem areas, and guide the development process as close as possible to a desired terminal outcome. For example, even the study of a crude estimate of groundwater resources vis-a-vis rough speculation on the demand for water, can

Table 1 : Population of India—2000
(Million)

Estimate	Population	
	1985-86	2000-01
High	795.7	1025.8
Low	744.7	911.1

indicate where recharge efforts should concentrate, or to what extent industrialisation should be dampened in a particular area to establish an optimum balance between demand and supply. It is in this spirit that the planning for water use in India in 2000 has been discussed. The study outlined in this paper deals with order-of-magnitude of resource demand and supply and should not be misconstrued as a forecasting exercise.

The approach

The study has been divided into three distinct parts:—A. availability of water resources; B. demand for water resources; C. implications of supply-demand perspective. They are interwoven into a broad framework given by the population and economic growth which are considered as the fundamental determinants of a growth process. Precise estimates of these factors are complicated by the fact that the terminal year of projection is 25 years away. It is difficult and not wise either to assign

single values to these factors. Instead, a series of values has been derived through internally consistent models under alternative assumptions on relevant parameters (Sarma 1974, Basu 1975). Several scenarios have been defined on alternative combinations of population and economic growth (Tables 1 & 2).

The scenario A, with low economic and high population growth, may be called a pessimistic scenario; and the scenario D, with high economic and low population growth, may be taken as an optimistic one. Given these broad patterns of growth of the economy and population, planning implications of water use in terms of resources and demand have been examined. For illustrative prognosis only the extreme scenarios have been used.

Resource availability

India is a vast country with diverse climatological, geological and physiographic characteristics. Rainfall which determines the magnitude of surface flows and groundwater recharge is highly variable both in space and in time. Much depends on the efforts and appropriate technologies that go into harnessing it. The primary objective should be to utilise as much as possible of 370 million hectare-metres of rainfall that India receives on an average in a year.

In India, an assessment of resources is severely constrained by a poor data base. For surface water, time series estimates are not available to permit computation of annual volumes of flow with a suitable dependability factor.

Table 2 : Indian economy : 1985-86 and 2000-01

Scenario	Estimates		Rate of growth of G.D.P.* (%)		Per Capita G.D.P. (Rs)	
	Economy	Population	1970-85	1985-2000	1985-86	2000-01
A	Low	High	3.6	4.0	859	1,200
B	Low	Low	3.4	4.4	892	1,390
C	High	High	4.6	5.8	983	1,776
D	High	Low	4.4	6.0	1,020	2,000

* Gross domestic product at market prices (1970-71)

Planning water use for 2000 A.D.

By Abhijit Lahiri

The three rough measures of surface water resources available are:

	Million hectare-metres
(i) First Irrigation Commission (1903)	144.32
(ii) Khosla Estimate (1949) ..	167.23
(iii) Central Water and Power Commission Estimate (1960)	188.19

The difference between precipitation received and surface flows is explained by evapo-transpiration and infiltration

There is little rationale to discard one estimate for the other. However, if this be the order-of-magnitude, it really does not matter which one is nearer the truth, because India has so far harnessed only about 15 per cent of resources given by even the lowest estimate.

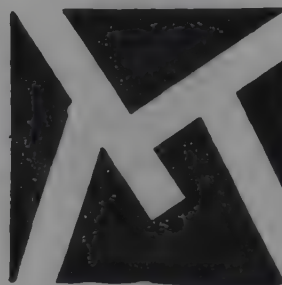
Similarly, knowledge of groundwater resources is also limited. Raghava Rao and his associates (1969) made a very rough assessment of net annual recharge to groundwater which is put at 26.7 million hectare-metres. However, such an estimate has little relevance in reality because the quantum of recharge could be vastly different in direct relation to the magnitude of annual withdrawal.

Due to limitations of various kinds, it may not be possible to harness the entire resources. The Irrigation Commission, 1972, maintained that the utilisable surface water resources of India are 66.6 million hectare metres, i.e., about a third of the high estimate of total resources, because suitable sites for dam and diversion projects are not available in all cases. Utilisable ground-

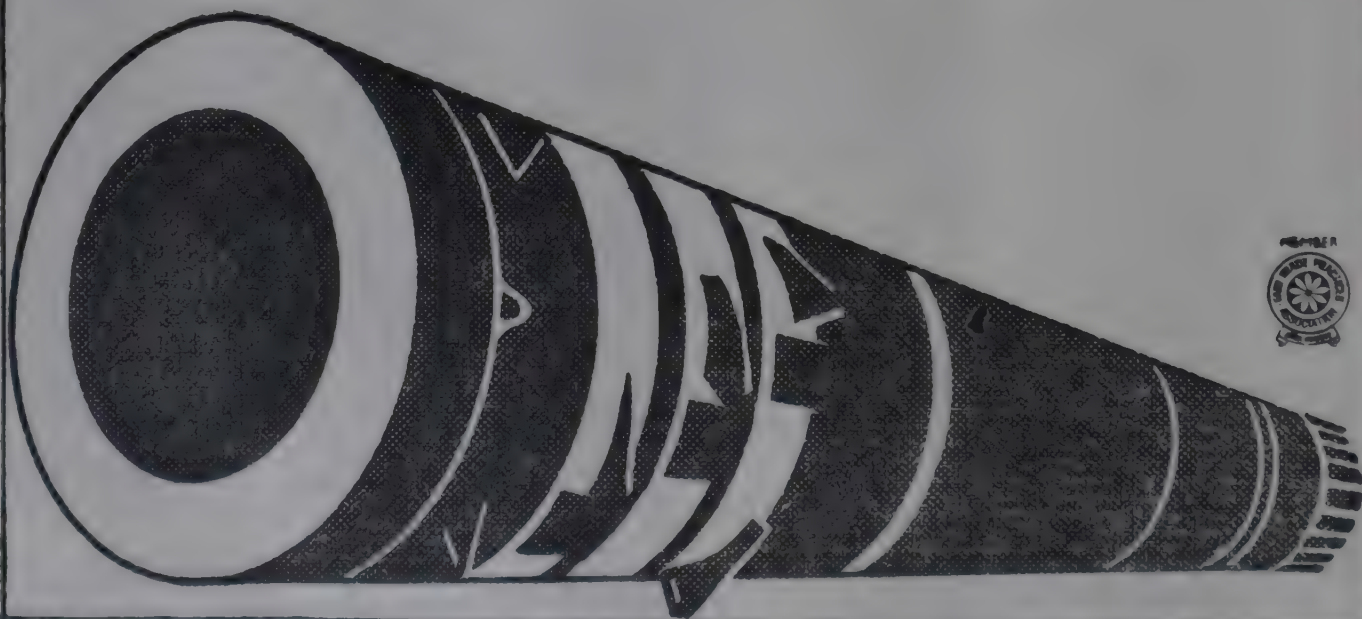
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er, on the other hand, is about 75 per cent of the total resources i.e., 20.4 million hectare-metres. In sum, about 10 million hectare-metres of water from surface and subsurface sources is available for long-term development in India.

Demand of water resources

The following scheme of classification has been used to discuss the demand for water in 2000.

- (1) **Withdrawal uses:** Water is physically withdrawn from water courses, aquifers and the like to satisfy consumption requirements of households, livestock, industries, thermal power generation and agriculture.
- (2) **Flow uses:** Flow is utilised in the water course itself and does not entail physical removal from water course, e.g., water for navigation, hydro-electric power generation, waste dilution and disposal and pisciculture.
- (3) **On-site uses:** Water is used in place e.g., to foster wild life habitats and to provide recreation.

Flow and on-site uses

The flow and on-site uses do not correspond to depletion from the total resources because water once used may be re-used down stream (which is also true for certain categories of withdrawal uses). However, there are certain exceptions to this concept. A part of water received through precipitation annually needs to be apportioned for such purposes, e.g., sufficient water to keep a river system navigable. Once again, water used for waste dilution and disposal may not be suitable for withdrawal consumption. This, in effect, implies depletion of a given quantity of resource from the total.

Table 3 : Annual withdrawal needs other than irrigation : 2000
(Million hectare-metres)

Purpose	Annual withdrawal needs		Part expected to be satisfied by ground water
	Low	High	
Domestic	2.116	2.495	2.5
Livestock	0.465	0.605	
Manufacturing	1.698	3.901	1.0 - 2.0
Power generation	3.600	9.333	1.0 - 2.0
Total	7.879	16.334	4.5 - 6.5

NOTE : The "withdrawal" required, does not exactly correspond to "depletion" of resources. A part of water withdrawn rejoins the water bodies and can be used again.

Table 4 : Summary outlook : demand and supply in 2000
(Million hectare-metres)

Resource	Utilisable resources	Demand		
		Other than Irrigation	Irrigation	Total
Surface water	66.6	3.4 to 9.8	45.6	49.0 to 55.4
(major, medium and minor)				
Ground water	20.4	4.5 to 6.5	21.0	25.5 to 27.5
Total	87.0	7.9 to 16.3	66.6	74.5 to 82.9

The waste dilution and disposal problem may not be very alarming today, but it will surely be so in future because of rapid industrialisation and an increasing awareness to pollution abatement. It is anticipated that this category of use will stake a large claim on water resources of the country. However, the water demand on account of such uses is not easily quantifiable, and has not been attempted in this exercise. The rest of the discussion concentrates specifically on withdrawal uses only.

Withdrawal uses of water other than irrigation

Total withdrawal need of water other than irrigation (Table 3) is expected to lie between 8 and 16 million hectare-metres in 2000 (Lahiri, 1975 a, b).

The quantity projected is not very significant, but detailed considerations of quality and regional disparities of demand may radically alter the perspective.

Domestic demand will mostly be from urban centres—26 per cent of the population living in these areas will account for nearly 55 per cent of total domestic consumption. Millions living in rural areas will not have drinking water supplies of standard quality mainly due to other investment priorities, and will continue to nourish rich growth of micro-organisms in their digestive system. No less than 10 per cent of food intake is consumed by such micro-

organisms. India can, thus, save 20 million tonnes of food materials per year in 2000, if safe drinking water is supplied to the entire population. The criticality of the problem needs no further elucidation.

In the manufacturing sector, water consumption in different sub-sectors will not be uniform, "basic metals" alone accounting for nearly 72 per cent of withdrawal needs. The rest of the demand, in the main, will be explained by machinery, chemicals, petroleum products, paper and pulp, and textiles. Concentrated demand pockets will also be created by thermal power generation activity.

A major part of water withdrawn goes for cooling activities which may be managed either through open or closed circuit processes. Though depletion remains more or less the same, intake water requirement of once-through processes is disproportionately high. Once-through processes also require suitable sites for dumping water with waste-heat which has adverse effects on the natural ecology of the region. Hence, continued efforts should be directed to effect a shift from once-through to close-circuit processes in order to conserve water resources and also to preserve the natural ecology.

Agricultural consumption

Consumption of water in the agricultural sector is by far the highest the magnitude being so large as to render consumption in all other sector insignificant. The starting point for projection of water consumption in the agricultural sector should ideally be the demand estimates of agricultural produce. The approach would provide realistic results only if the inter-play of all inputs which have direct relevance to yield of crops like water and fertiliser, soil-climatic conditions, motivation of farmers and technology are integrated into a model. A simpler alternative is to test the feasibility of achieving the declared national objectives.



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The Draft Fifth Five Year Plan document maintains that the ultimate irrigation potential of the country is:

	Million hectares
Major and medium surface water schemes	57
Minor surface water schemes ..	15
Groundwater schemes	35
Total of all schemes	107

About 74 per cent (42 million hectares) of major and medium surface, 100 per cent of minor surface (15 million hectares), and groundwater (35 million hectares) ultimate potential would be created by 2000 (Lahiri 1975 a). In other words, about 52 per cent of the projected net cultivable area and 28 per cent of the total geographical area of the country could be brought under irrigation by the end of this century. With an average delta of 0.8 metres for surface and 0.6 metres for groundwater, irrigation of the said magnitude implies utilisation of 45.6 million hectare-metres of surface and 21 million hectare-metres of groundwater.

Implications of demand-supply

Resource adequacy: Macro-level comparisons: The demand-supply situation portrayed in Table 4 is not comfortable.

Withdrawal demand of groundwater exceeds utilisable resources, if it were to sustain the high growth of the economy as implied by the accelerated development of manufacturing and the energy sectors. As a matter of fact, the entire groundwater resources seem to be committed to the agricultural sector alone. Groundwater demand from sectors other than irrigation, which add up to a substantial quantity of 4.5 to 6.5 million hectare-metres in 2000, has not adequately been taken care of, while planning allocation between competitive demands.

This is also partly true of surface water allocation. Presumably, there will be no resource bottlenecks to surface water development till 2000. Beyond 2000, raising irrigation potential from major and medium surface water schemes from 42 million hectares (33.6 million hectare-metres) achievable by 2000, to 57 million hectares (45.6 million hectare-metres) in ultimate, implies an additional withdrawal of 12 million hectare-metres. By then, water demand of sectors other than irrigation will also rise severalfold. As a result, total surface water withdrawal demand will exceed 66.6 million hectare-metres of utilisable resources. This gives rise

Table 5 : Capital availability for irrigation

(Rs billion)

Year	Scenario A			Scenario D		
	Quinquennial NCF	Quality on Irrigation		Quinquennial NCF	Quality on Irrigation	
		Quinquennial	Cumulative		Quinquennial	Cumulative
1971-76	250	29	29	261	31	31
1976-81	297	35	64	367	43	74
1981-86	387	45	109	541	63	137
1986-91	476	56	165	774	91	228
1991-96	602	71	236	1,156	136	364
1996-2001	804	94	330	1,750	205	569

to serious doubts as to the feasibility of achieving 57 million hectares of surface water irrigation potential (ultimate) through major and medium schemes.

It is not clear, however, whether the 12 million hectare-metre water utilisation, through minor surface schemes, has been accounted for in the utilisable surface water resource estimate of 66.6 million hectare-metres. The inclusion of this volume of water (12 million hectare-metres) for utilisation, through major and medium schemes, establishes the feasibility of obtaining the ultimate irrigation potential of 57 million hectares.

A silver lining: In this context, it should be mentioned that the statements made above are subject to further qualifications. Inherently, the estimates of natural resources are not robust. Errors to the tune of at least 25 per cent exist. If it is so, optimistically, utilisable surface water resources rise to 83.2 million hectare-metres and groundwater to 25.5. In such a case, the scope of surface water development is considerably extended. Groundwater resources also turn out to be marginally sufficient.

Moreover, the utilisable surface water resources have been estimated in the context of projects feasible as per present levels of price and technology. In regions of supply-demand imbalance, the value of water will increase. This would render costlier projects economically viable.

The regional disparities: So far, only macro-level comparisons have been discussed. Such comparisons, however, are not adequate to define the supply-demand situation of a commodity like water which does not have a national market. Resources are not uniformly distributed. Demands are also location specific. Locations of human settlements, manufacturing and power generation activities are controlled by many factors—availability of water is one of them, major or minor, depending on the type and magnitude of activities.

Even today, non-uniform demand, superimposed on uneven distribution of resources, paints a dismal picture. This is true of both surface and groundwater. The problem will definitely accentuate in future. An inter-regional transfer of water will, thus, be an imperative to smoothen down the imbalances.

A corollary: Regional disparities and resource constraints even on considerations at macro-level bring out another facet of the problem i.e., resource allocation between competing demands. As a principle, the domestic and livestock demand should be satisfied first on humanitarian grounds. Industrial and thermal power consumption comes next owing to higher returns per unit of water. However, as per present trend of commitments, irrigation enjoys an overwhelming share of utilisable water resources. This would create vested interests in agriculture, and it will be difficult to deny the irrigation facilities once committed, when demand of other sectors picks up. Today, when utilisation is well below potential supplies, the criticality of the problem may not be appreciated. However, the growth of the demand for water in manufacturing activities and thermal power generation will accelerate beyond 2000. This situation, thus, calls for restraining excessive commitments to irrigation at least in specific localities where demand of other sectors is likely to grow.

Augmentation of resources

There is considerable scope to augment utilisable resources and also to increase returns per unit of water if decisions are taken promptly, the gestation period of utilisation of potential is minimised and appropriate technologies are adopted.

Cost of delayed decisions: Utilisation of surface water in India has been dampened by inter-State disputes on allocation of water in major river valleys. As high as 20 million hectares of irrigation potential is locked up in legal

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angles. The opportunity cost of the delay due to this delay in decision-making is formidable. India loses, on an average, about 34 billion worth of additional agricultural output a year. In terms of commodities, the annual loss is 34 million tonnes of cereals, i.e. about 30 per cent of the quantity produced in India a year. The amount is sufficient to feed an additional population of 170 million and thus calls for the urgency with which the legal problems need be solved. It should also be mentioned that, for optimum utilisation of water resources, a river system should be viewed in an integrated framework nullifying the artificialities of State boundaries for greater interests of the nation as a whole.

Under-utilisation of potential: Under-utilisation of irrigation potential is yet another area which needs closer scrutiny. The opportunity cost of the loss in production due to 5 to 10 years gap between creation and utilisation of potential is high, which in many circumstances may change the initial estimates of cost-benefit so radically as to negate the economic viability of the project altogether. Construction of field channels and land preparation have been the responsibility of beneficiaries, which are seldom being carried out in time mainly due to financial and also due to motivational problems. The period of under-utilisation may be reduced if liberal credit facilities and know-how are supplied to the farmers well in advance of creation of the potential.

However, in certain cases perhaps, the creation of irrigation potential was not called for—this is particularly true of run-of-the river schemes in high rainfall areas where farmers have little incentive to utilise an irrigation facility unless it is made available in non-monsoon seasons also. Thus, it is necessary to define priorities on detailed socio-economic and motivational criteria, and take up the projects in order.

Technology for augmenting resource supplies: There are technologies through which the supply position could be vastly improved upon. Most important of them is the "conjunctive use of surface and groundwater resources." In the areas of surface irrigation, the groundwater system receives additional recharge from seepage from canals and fields. The rise in the groundwater level needs to be controlled to prevent water-logging. The malady could be turned into a boon if the groundwater system is designed to act as a supplementary source of irrigation in canal-

irrigated areas. The groundwater buffer storage created can take adequate care of the demand during the non-monsoon period and also in drought years.

Additional quantities of run-off can also be captured for beneficial use through surface schemes like tanks or in groundwater reservoirs. However, evaporation losses from traditionally designed schemes are so high as to render them uneconomic. In contrast, the evaporation loss from groundwater is insignificant. In alluvial tracts like the Ganga basin or in channel deposits, over-pumping may be resorted to. The room created will facilitate accommodating excess recharge in the following monsoon season.

Desalination and artificial rain-making are two other important resource augmentation technologies. However, the economics of the desalination technique is yet to be evolved and the effectiveness of the artificial rain-making method is yet to be proved. The adoption of such techniques may be imperative in certain pockets of demand-supply imbalance like Madras or in coastal regions of Gujarat State, but their impact on national demand-supply is not going to be significant by 2000.

Technology to increase utilisation per unit of water: The choice of an objective between maximisation of returns per unit of land and maximisation of returns per unit of water is not immediate. While the former promises higher income at the farmer's end, the latter has more significance at the national level. However, with increased experience and enlightenment, the shift from traditional to improved techniques which lead to maximisation of returns per unit of resource is automatic, especially when resource development approaches saturation. Though such improved techniques of water application like sprinkler and drip irrigation are yet to be tested on a large scale, in Indian conditions, it is envisaged that the methods will prove beneficial in arid and semi-arid regions like Rajasthan and Gujarat.

Financial implications

Sufficiency of capital: The projected irrigation development will require a net sum of 136 billion rupees—71 billion rupees for surface water development and 65 billion for groundwater (Lahiri 1975 a). Capital availability for irrigation projects has been estimated from Net Domestic Capital Formation (NCF) during the 30-year

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od between 1970-71 to 2000-01 (see le-5). Since the First Five Year n, irrigation has enjoyed a large re of total capital outlay. In the First n, it was as high as 18.78 per cent in the subsequent ones the share ged between 10 and 12 per cent. If the tern of investment remains the same, ital availability for irrigation devel- ment will be as high as 330 billion ees under low and 569 billion rupees der high growth scenario against the uirement of only 136 billion rupees. wever, it is expected that the share rrigation will be considerably reduc- in future due to a parallel rise in portance of competitive sectors. ooking at the fact that the net irriga- on development calls for only about per cent of NCF under low and about per cent under high growth scenario, may be postulated that the projected rrigation development will not face nancial constraints at least till 2000. owever, the long gestation period of onstruction of major and medium pro- ects puts a constraint on harnessing the ntire potential. Substantial funds ould be diverted to introduce technol- ogies of conjunctive use and artificial echarge. It should also be possible to ake a small beginning to translate nto reality the concepts of inter-regio- al transfer of water.

Pattern of investment

The pattern of investment, how- ever, will largely determine optimum utilisation of irrigation potential creat- ed, especially in the level of marginal and small farmers. Nearly 75 per cent of operational holdings in India belong o size classes below 3 hectares. Agricul- tural operations on these tiny plots can- not produce enough for even subsistence living unless irrigation facilities are made available. Liberal advancing of credit is, thus, a prerequisite to rapid utilisation of irrigation potential creat- ed and for groundwater development. Putting the same land holding statistics in another fashion, 30 per cent of the total cultivable area is managed in 36 million small plots providing livelihood to roughly 36 million households constituted by a population of nearly 180 million. Where surface irri- gation cannot be given, suitable ground- water schemes must be formulated. So far, the construction of surface irriga- tion facilities has been the responsibi- lity of the government. In contrast, the initiatives for groundwater devel- opment are expected to be taken by the individual farmers only. However, in spite of liberalisation, the small and marginal farmers do not get much of the credit facilities because of their

questionable capacity of repayment and motivation. Joint ownership and co- operative ventures may be floated, but more governmental participation, both in terms of finance and technology, is called for. For the successful imple- mentation of conjunctive systems, how- ever, both ground and surface water development should be treated as state subjects.

Rate structure: Surface water rates in India are generally charged on the basis of crop-area-season; a system that leads to over-irrigation and thus wastage of water. In contrast, groundwater is generally sold on pumping per hour which forces more stringent use. Ironi- cally, however, groundwater costs 10-20 times more than surface water. If groundwater were to be used in conjunc- tion with surface water in all canal- irrigated areas, the disparities in the rate structure should be reviewed altogether.

A concluding note

The perspective drawn is not that of water famine which many experts predict for 2000. It is, nevertheless, acknowledged that a crisis at the micro- level will be precipitated in the not-too- distant future if adequate measures are

not taken now. The adoption of an appropriate pattern of finance, technology and modern management techniques can change the face of the situation altogether. Some of the policy changes advocated have political con- sequences. Planners today should be equipped to take such radical measures, to prepare a base for the better future of the country.

References

- Basu D. N., 1975 : *Macro-economic Frame- work: 2000 A.D. under A Long Range Perspec- tive for India* (LRPI) Operations Research Group (ORG), Baroda, Monograph.
- Chaturvedi, M. C., 1974 : *Water in Second India, Second India Studies*, Ford Foundation.
- Lahiri Abhijit, 1975 : *Water Resources: 2000 A.D.* LRPI, O.R.G., Monograph.
- Lahiri Abhijit, 1975 : *Ground Water in India in 2000—the implications: Indo-German Workshop on Ground Water*, May, 1975, NGRI.
- Ministry of Irrigation and Power, 1972 : *Report of the Irrigation Commission: Shree Saraswaty Press*, Vol. I-IV.
- Planning Commission : *Draft Fifth Five Year Plan 1974-79* : Vol. II—pp. 105 to 117.
- Raghava Rao K. V., et al, 1969: *An estimate of the ground water potential of India—First approximations; Symp. Soil and Water Management*, March 1969.
- Sarma D. V. N., 1974 : *Population: 2000 A.D.*, LRPI, O.R.G., Monograph.

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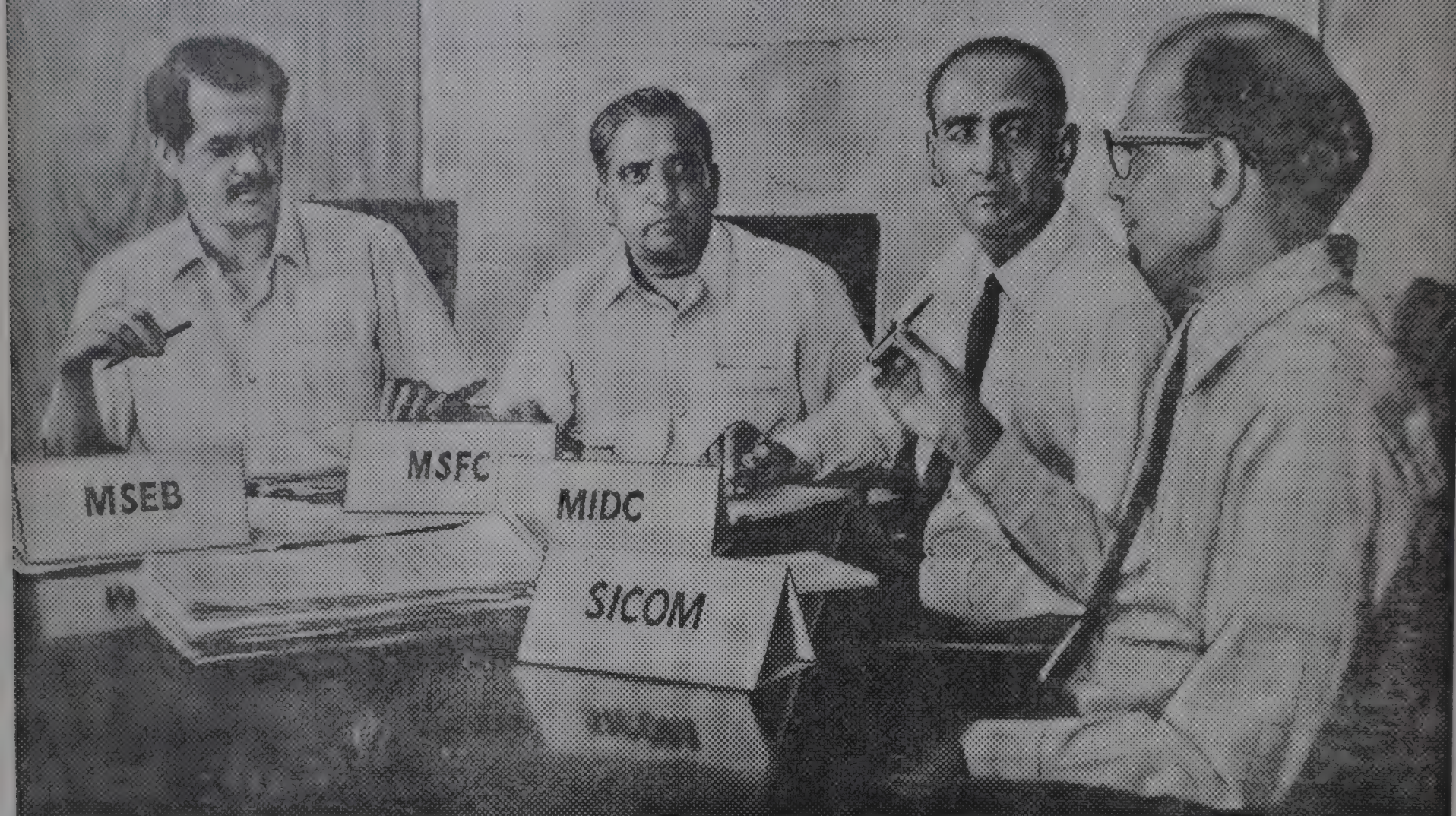
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THE winds in those parts which they call the Monsoon, blow constantly easterly but few points six months westerly the other six northerly." This is the observation of Edward Terry in the early 17th century regarding the climate of Indus. The winds, blowing from southwest over the Bay of Bengal and the Arabian Sea for five months and from northeast for another five months, came to be known as the "Monsoon" from the time of the early European sailors in Indian waters.

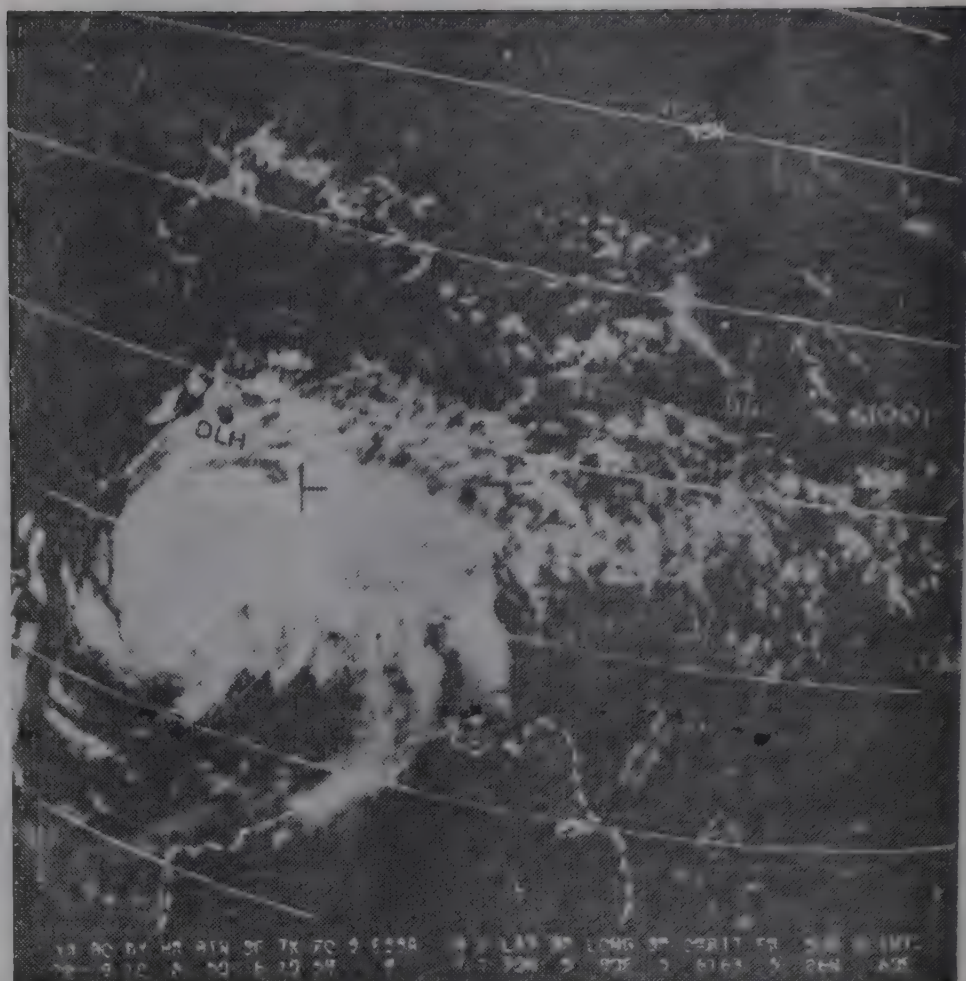
"Monsoon" is a transformation of the word 'mausam,' meaning weather, from the Arab sea-men. The southwesterly winds laden with moisture drawn from the sea spread over the Indian sub-continent and cause bountiful rains for four months. 'Monsoon' has come to mean this rainy period from June to September. The northeasterly winds of the later period are only dry winds, except over Tamil Nadu and nearby where they cause rains. The principal rains are for some time after the onset of northeasterlies and in that region these rains are no doubt called 'Northeast Monsoon.'

The Southwest Monsoon is the greatest bounty conferred by nature on our country. The average rainfall from June to September over the plains of India is about 87 cm amounting to 2,300 million acre feet. The entire kharif crop and most of the hydro-electric power are the benefits flowing from the Southwest Monsoon. But for this, India could not have supported its vast population. Our greatest natural resource is the Southwest Monsoon which renews our water supply year after year. Naturally, from the time scientific meteorology began in this country in the nineteenth century, efforts have been made to unravel all the facets of the Monsoon.

Heat low

The most crucial feature in the development of monsoon is the low pressure area running from Arabia to Central Asia and beyond, with the core of lowest pressure near about North Baluchistan. Intense heating of the ground and lower atmosphere causes the low pressure area, consequently called heat low. According to the laws of air flow around low pressure areas, the winds over India would be from southwest or some southerly direction thus enabling maritime airmass which can give rains, to spread over the country. To the west of the low pressure belt

View of a monsoon depression cloud from satellite (depression centred near Jabalpur at 1420 IST on September 12, 1972).



Dynamics of monsoon

By Y. P. Rao

land air prevails, leaving the area dry. Luckily the position of the principal low pressure area over the Indian sub-continent is further north than in Arabia or Africa, which otherwise would have limited the sway of the monsoon to the southern peninsula only, as over southwest Africa. The tapering shape of the peninsula flanked by sea on the two sides and the dynamical influence of the Himalayas on the circulation of air are perhaps responsible for pushing the main heat low to Baluchistan.

Cross-equatorial flow

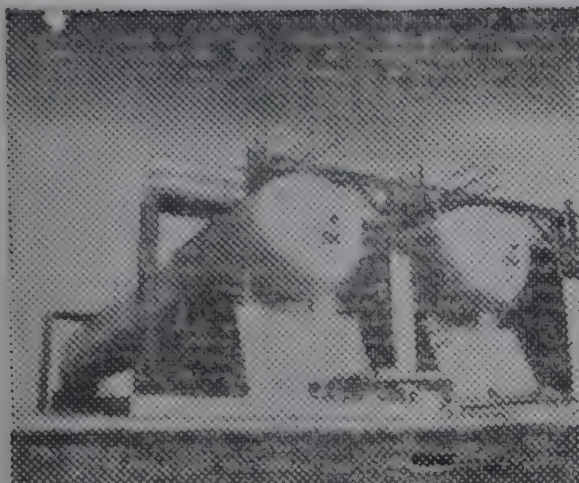
Air is exchanged across the equator between the summer and winter hemispheres over the globe. In the lower atmosphere the flow is from the winter hemisphere and the compensating transfer is aloft from the summer hemisphere. In the period of the southwest monsoon, air flows from the south Indian Ocean across the equator into the Arabian Sea and the Bay of Bengal in the lowest layers of the atmosphere.

The most pronounced cross equatorial flow is like a jet near Kenya coast, reaching 100 kilometres per hour (KM-PH) over a stretch of a few hundred kilometres. Variations in its intensity seem to influence subsequent monsoon rains along the west coast of India.

Airmass

Thus the air streaming over the country would have travelled over the Indian Ocean, Arabian Sea and Bay of Bengal for many days. Evaporation from the sea surface is expected to nearly saturate the airmass with such a long marine travel. This concept was proved to be wrong, particularly by the soundings of the atmosphere made during the International Indian Ocean Expedition (IIOE). In the western Arabian Sea the moist layer in the atmosphere is very shallow while off the west coast a deep layer is built up. The exact mechanism of the change is not understood. Warmer surface of the east Arabian Sea, dynamics of the low level jet extending from near Kenya to south Arabian Sea and the

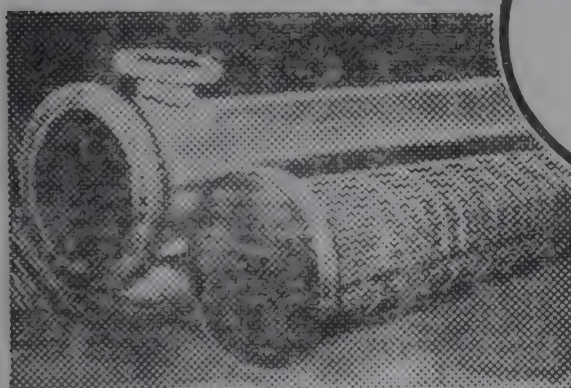
Mr Rao is Director-General of Observatories, Government of India.



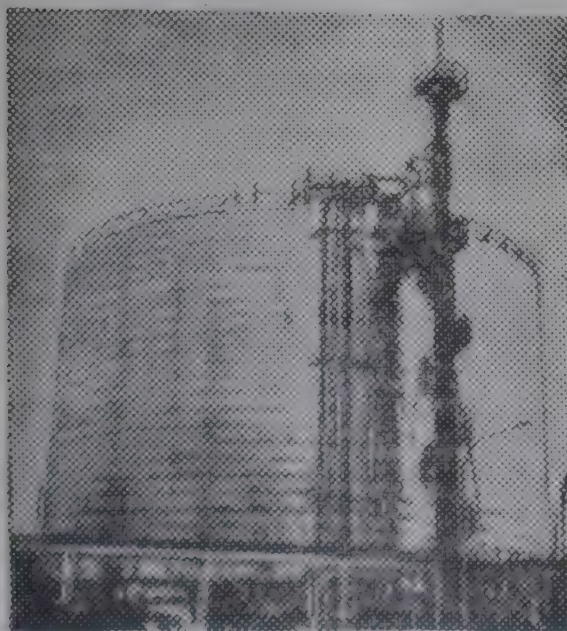
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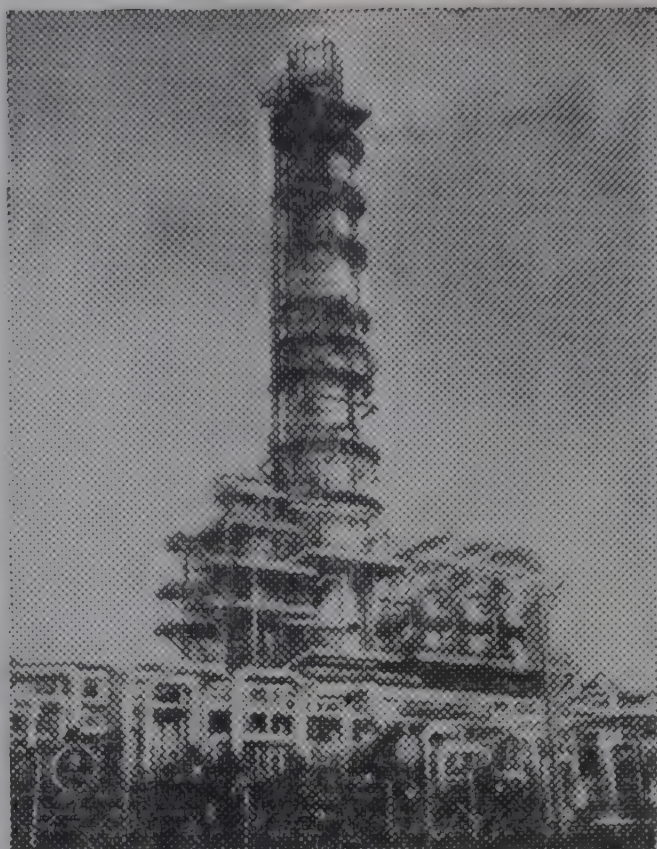
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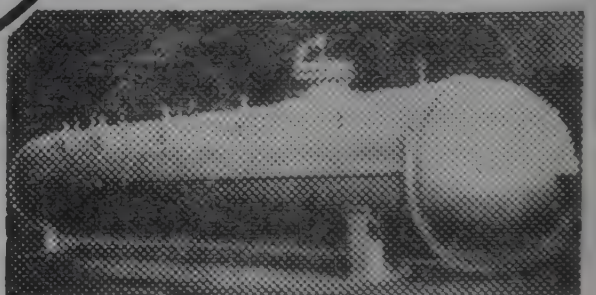
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mechanism of weather systems off the west coast of the country have all some part in the transformation of airmass from west to east Arabian Sea. Some meteorologists have argued that the monsoon airmass in the Arabian Sea falls from the deserts of west Asia and this does not appear tenable.

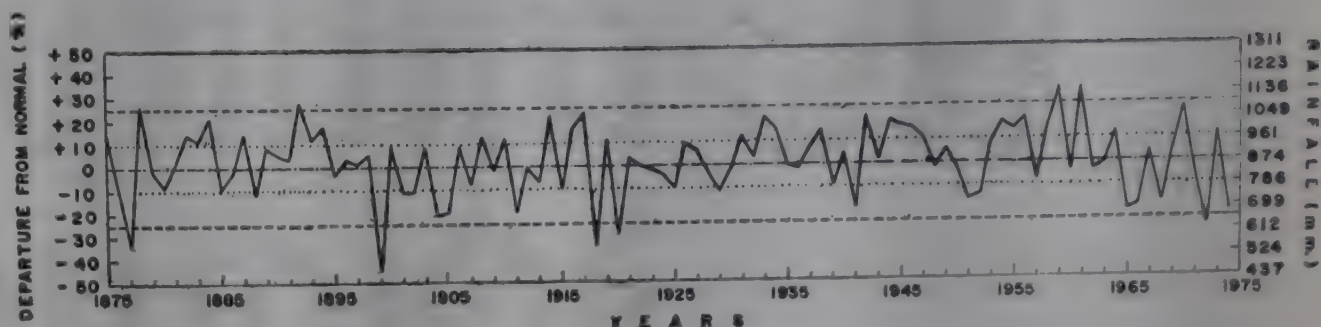
Somali upwelling

Cold waters from the depths of the Indian Ocean are known to rise to the surface in some regions, a phenomenon called "upwelling." Ocean currents induced by wind stresses, spread out the surface waters particularly near coastal boundaries, and upwelling is compensating supply of water from beneath. Off the coasts of Somalia and Arabia, sea water is very cold due to upwelling. There is an interaction between the winds and the ocean currents and very strong southwesterly winds with only a shallow layer of moisture blow off these coasts and spread into south Arabian Sea. Cold sea inhibits transport of moisture from sea surface high into atmosphere. Recent computer simulation indicates that lower sea temperature off Somalia is unfavourable for good monsoon over India.

Monsoon trough

Over India itself a belt of low pressure runs from Amritsar to Calcutta, called the monsoon trough. To the south of this line, the winds are from the west in some westerly direction and elsewhere from east. The trough is not due to excessive solar heating, like the heat low over Baluchistan. Some meteorologists have argued that the trough is

HUNDRED YEARS OF MONSOON RAINFALL IN PENINSULA



a dynamic configuration induced by the run of hill ranges in Burma and Assam and Himalayas to the north or caused by the rather warmer air to the north of the troughline. Whatever be its origin, the trough oscillates markedly to north and south, sometimes very fast, and exercises an all-pervasive influence on the distribution of rains. When located near the Himalayas, heavy downpours can occur in that region, while the rest of the country may go dry. Monsoon depressions may form when it runs into North Bay.

Depressions

Monsoon season is not a period of regular rains in measured amounts in all parts of the country. Atmospheric flow patterns at various levels of the

atmosphere control the areas and amounts of rainfall. Monsoon depressions which form over the north Bay of Bengal and travel across the country west-northwest, are most useful in giving rains directly or indirectly over wide areas in a few days, though resulting in floods sometimes. The main rain area is in the southwest quadrant of depressions. The life period of a depression is three to six days, during which time the system may even reach Pakistan or weaken over central parts of India or change course northwards. Indian meteorologists are keen to study the formation of these depressions in the spawning area of north Bay by mobilising ships and aircraft to record detailed observations.

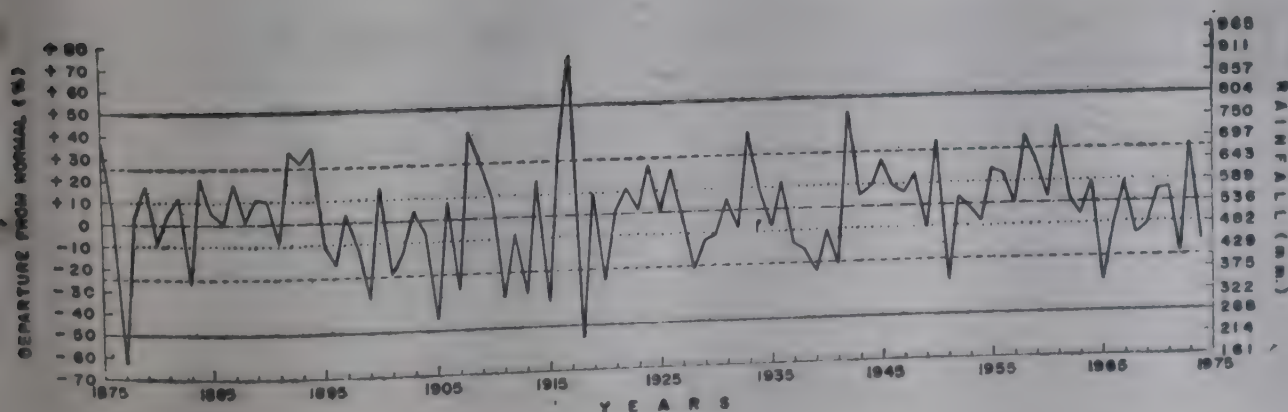
Break in monsoon

A 'break' in monsoon rains, if prolonged, can cause anxiety. The monsoon trough then takes a position near the Himalayas. Besides heavy rains in that region, Tamil Nadu also gets more than its usual rainfall which is not much in this season. Middle of August is most susceptible to breaks. Himalayan rivers can run in spate, particularly Brahmaputra, in the lower catchments in spite of lack of rains there. Semi-stationary large amplitude waves in the westerly flow over Central Asia coming near India seem to cause the breaks in monsoon. Drier continental air may replace the monsoon airmass over northwest India during long breaks.

Central Asian systems

Monsoon rains over northern India are also beneficially influenced by the weather systems moving over Central Asia, apart from causing breaks. North of Kashmir, airflow continues from west

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the middle and upper levels. Wave-like deformations are travelling eastwards and their tails may trail into the Indian monsoon regime. The signs are subtle but many spells of rain are definitely due to perturbations from the north. Deficiencies of observations at the northern borders are a great handicap to forecast these spurts of monsoon activity. Even monsoon depressions are pulled northward from their usual track, by the waves in westerlies further to the north.

West coast rains

Quite often a weak trough of low pressure forms over sea, off parts of the west coast and causes rainfall disproportionate to the strength of the trough itself. As the trough creeps northwards, the rain belt also shifts similarly. Some meteorologists have pictured that the weak trough at surface is a manifestation of a stronger low aloft. This is another system requiring further study urgently.

High pressure

Near about the Tropic of Cancer runs an area of high pressure called the sub-tropical High. The position varies from place to place and with season. Intense heating obliterates this High over land in summer and replaces by the heat low described earlier. However, the sub-tropical High persists in the upper atmosphere and is broken up into a number of cells. Pakistan and adjoining scanty rainfall regions of India are under the regime of the eastern portion of a High Cell, from two kilometres upwards. Slowly sinking dry warm air obstructs rain producing systems.

Another High Cell from the east keeps the rest of Northern India under the umbrella of its western portion which is not unfavourable for rainfall. The extension of this cell so far is abetted by the 'Tibetan High,' regarded as the outcome of heating of this plateau.

Easterly jet

Winds during the monsoon are from the west below a height of about six kilometres over the Peninsula. Aloft east winds prevail all over the country. Stronger westerlies are a characteristic of strong monsoon. During breaks the peninsula shows weak winds, though these may be stronger in the northern plains. The east winds above six km strengthen with height, concentrating into a core of 200 KMPH between Trivandrum and Madras at 16 kilometres, called the easterly jet, which is a characteristic of the monsoon over south Asia. Attempts have not been lacking to re-

late all features of the monsoon with the dynamics and fluctuations in the easterly jet, which appear to be oversimplification of the complex monsoon phenomenon.

Onset and withdrawal

Advance and withdrawal of monsoon are highly variable features. On the average, starting in Kerala at the beginning of June, monsoon reaches Calcutta by 7th June, Bombay 10th June, Ahmedabad 14th June and Delhi 27th June. Withdrawal commences from the outlying parts of NW India by the middle of September and in a month the circulation is changing to the pattern of the next season. Rains are the sign of monsoon and in a place like Bombay or Delhi, setting of monsoon rains is quite identifiable. In Kerala and Assam, the pre-monsoon showers are as marked as the monsoon. Meteorologists fix the advance of monsoon by the atmospheric circulation evolving to the monsoon configuration. In regions of low rainfall like Deccan, a week or two may have to elapse after the onset of monsoon, for the soil to build up enough moisture to permit sowing. Marked delays in advance of monsoon or early withdrawal may affect agricultural operations for the year beyond retrieval.

Variability

India is lucky to have rainfall statistics at least from 1875 onwards from a sufficient number of observatories. Average rainfall from June to September over the country ranges from 802 cm at Cherrapunji (Meghalaya) and 489 cm at Agumbe to 8 cm at Buili (Jaisalmer district in Rajasthan). The low rainfall over Deccan is partly relieved by the eastward flowing rivers of the peninsula, fed by the monsoon rains over the Western Ghats. The water lost into the Arabian Sea from the western slopes of the Western Ghats is untapped wealth as valuable as the off-shore oil.

Rainfall over any station, district or State, or even the whole country, is not the same from one year's monsoon to another. Standard deviation of season's rainfall is between 35 cm in Assam and 15 cm in West Rajasthan and 20 cm in Marathawada. In low rainfall regions, the coefficient of variability is 50 per cent. There are years when rains are scanty over large tracts, causing a large reduction in agricultural production. In 1899 famine year, deficiency of rainfall was 45 per cent over the peninsula and NW India. In the latter region 1918 deficit was even 55 per cent. In any

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period of successive five years at least two monsoons give normal rainfall.

Right from the establishment of the India Meteorological Department, the task of foreshadowing the coming monsoon rainfall has engaged the attention of research workers, but results are meagre. After the massive effort in the first two decades of the present century, the problem deserves to be investigated again now with the accumulated ocean of new information and compu-

ter methods. There are periods when deficit rainfall is more frequent. By extrapolating current trends, as much information as possible has to be derived for planning the country's economy.

Portents of global cooling since the forties have raised the question of any effect on monsoon. The evolution of the word monsoon shows that the phenomenon prevailed in the seventeenth century when the Little Ice Age was over Europe and even earlier. But what was

the distribution and amount of monsoon rainfall in the past ages? Were droughts and famine more frequent? The flourishing civilisation of the Indus Valley has been interpreted as a period of greater monsoon rains in that area than at present. Some years even now, are of that pattern. The climate of the Indian subcontinent has to be reconstructed for historical periods and even earlier eras to be able to project into the future.

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By P. Koteswaram

FORECASTING MONSOONS

It is well known that the Indian economy depends critically on the monsoons which bring seasonal rains essential for agriculture, irrigation and power production. Though considerable areas have been provided with benefits of irrigation, nearly 80 per cent of the cropped area in the country still depends upon seasonal rainfall. There are two monsoons in the country—the south-west monsoon in summer (June-September) and the north-east monsoon in winter (November-February). The former accounts for nearly 70 per cent of the annual rainfall. The latter produces more than 60 per cent of the annual rainfall of Tamil Nadu. These monsoons (or seasonal winds) have been known for millennia and taken advantage of for maritime commerce during the sail-ship days. They blow with great regularity and the average

dates of onset and withdrawal in different parts of the country have been determined with a fair degree of accuracy (fig. 1). The south-west monsoon sets in along the Kerala coast by June 1, extends to Bombay by June 10 and covers the whole country by the middle of July. It begins to withdraw from North-west India from the middle of September and recedes to the south peninsula by the middle of October. These average dates are subject to the margin of one or two weeks either side in individual years. The south-west monsoon is dependable, and there has been no case of total failure of the monsoon all over the country even in the worst drought years. The north-east monsoon over South India is, however, less dependable, and failures for extended periods of years leading to distress occur from time to time. Forecasts of these monsoons with accuracy and reliability have, therefore, assumed great importance for agriculture and other weather sensitive industries in the country.

The average annual rainfall of India is 105 cms, the highest for a land area of a similar size anywhere in the world. It is, however, highly variable both in space and time. Heaviest rains occur over the north-eastern States and along the west coast, Cherrapunji in Meghalaya receiving a record rainfall of nearly 1,000 cms. In contrast, some districts in south-west Rajasthan hardly receive 15 cms per year. The extreme south of the country gets less than 10 cms during the monsoon, while heavy rains of 160 cms lash the west coast of Kerala nearby (fig. 2). Variability in time also is conspicuous. Heavy rainfall areas have generally least variability (15-20 per cent) and low rainfall areas the highest variability (40-60 per cent) (fig 3). The arid and semi-arid tracts of the country extending from Rajasthan and Gujarat to the extreme south along interior Maharashtra, Karnataka, Rayalaseema and Tamil Nadu have, thus, poor and undependable monsoon rains. Even in the more dependable rainfall areas of north-east and Central India,

Dr Koteswaram, former Director-General of Observatories, is now Honorary Professor, Department of Meteorology and Oceanography, Andhra University, Waltair.

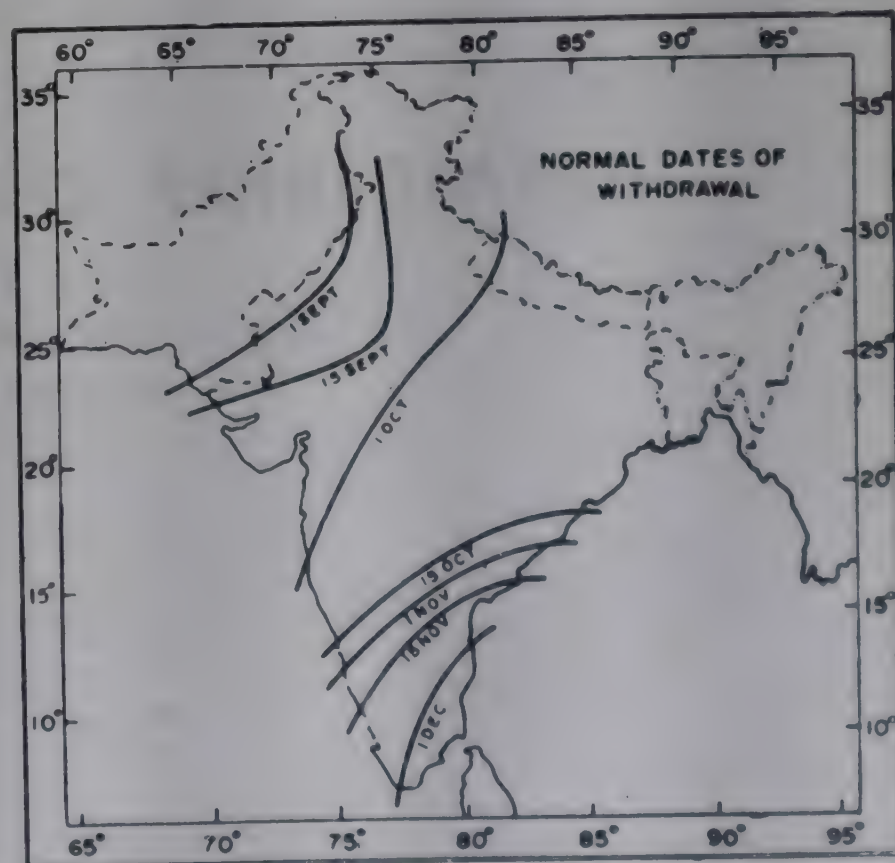
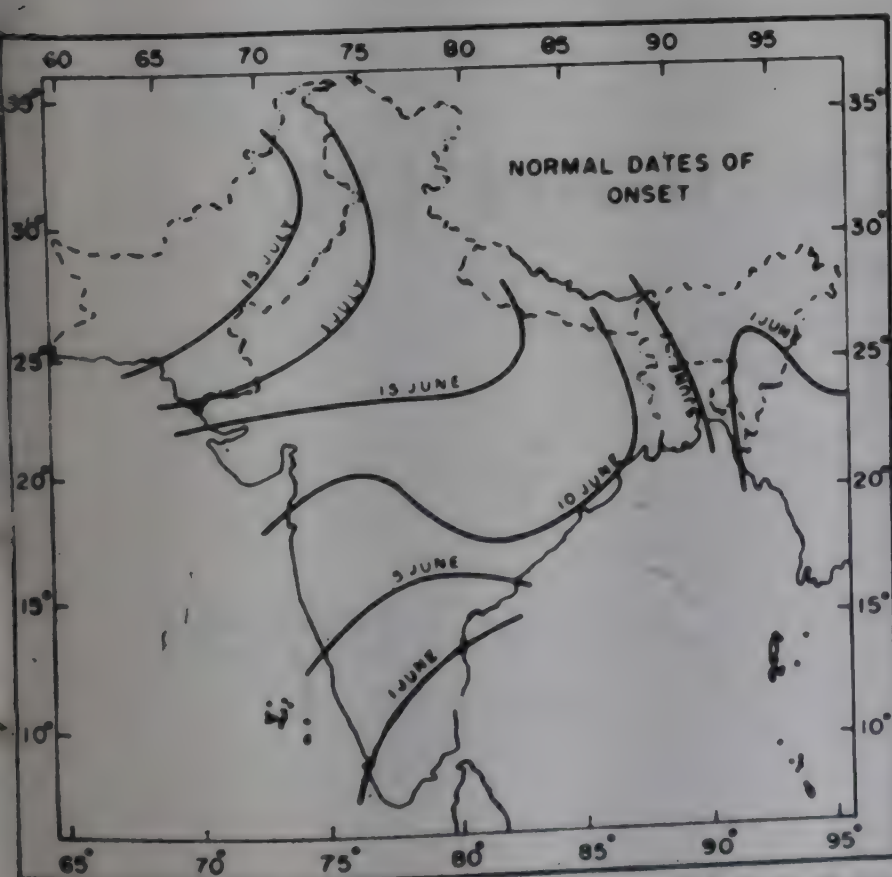


Fig.1. DATES OF ONSET AND WITHDRAWAL OF THE SOUTHWEST MONSOON OVER INDIA

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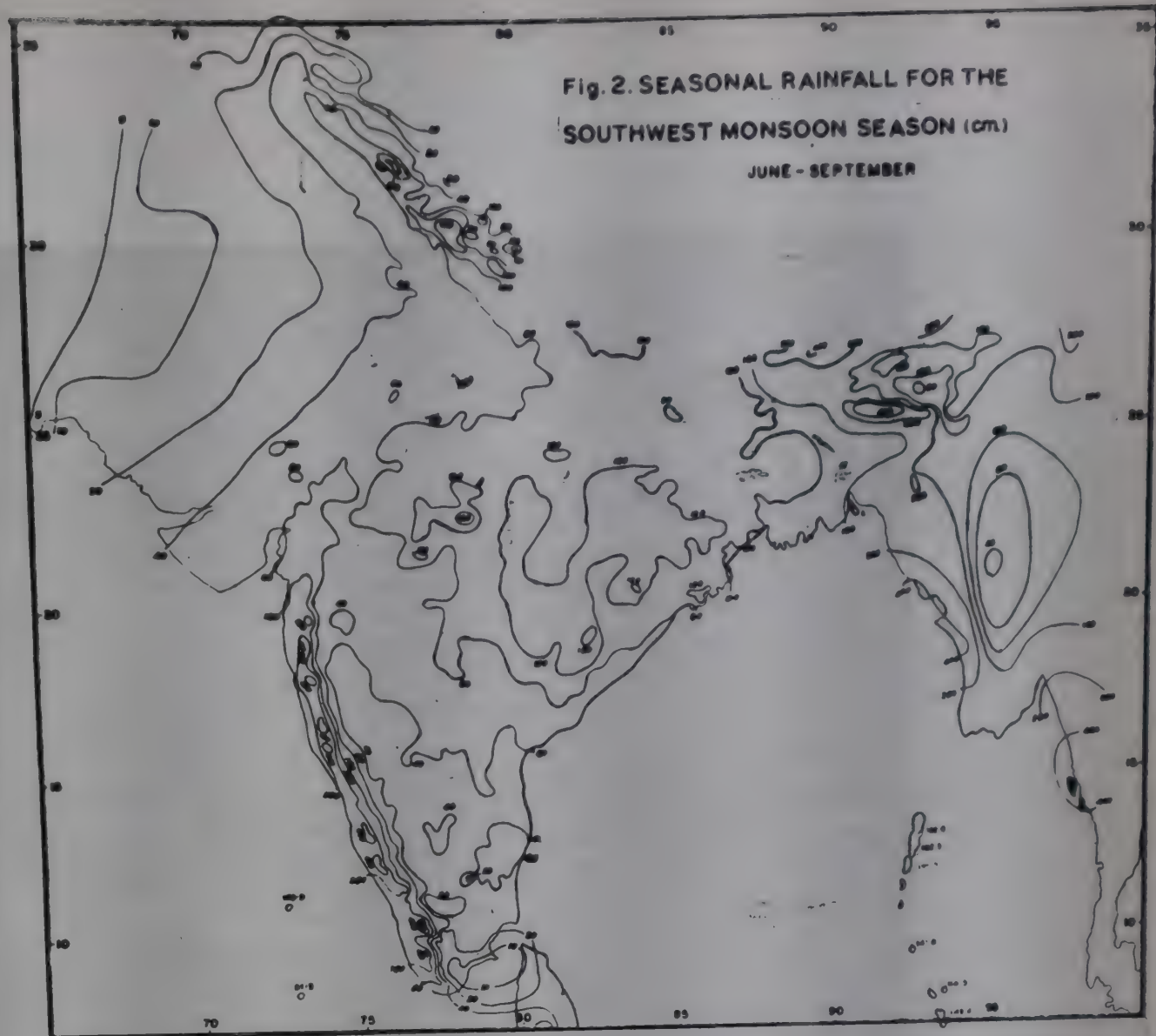
highly variability is quite high. There are years when the monsoon is plentiful in the first part of the season (June-July) and fails in the latter half (August-September) and vice versa, causing damage to crops.

Causes of variability

Though the monsoon rains from the Arabian Sea branch of the monsoon are copious and dependable along the west coast, their distribution inland is controlled by the occurrence and movement of monsoon depressions and/or low pressure areas from the Bay of Bengal. These depressions form at intervals of 2 or 3 per month during the south-west monsoon season over the north Bay of Bengal and move west-northwards across Orissa, north MP, south UP, east Rajasthan and Gujarat giving widespread and heavy to very heavy rains to the left of their tracks. These are responsible for floods in the rivers of north and central India. During years when the depressions are few and far between, rainfall in these areas is inefficient, leading to drought conditions. If they take a more northerly track across UP there is scarcity over MP and vice versa. During years when the depressions form at regular intervals and their tracks are distributed uniformly over north and central India, the monsoon rainfall is also well distributed over these areas. Such 'normal' years are rather rare, and wide fluctuations occur from year to year. 'Breaks' in the monsoon occur occasionally. During these 'breaks', there is very little rainfall over the country. Low-pressure areas from the south Bay of Bengal moving across the south peninsula give well-distributed rainfall over Tamil Nadu and South Andhra Pradesh.

The activity of the Arabian Sea monsoon is also controlled by low pressure areas in the mid-troposphere (4-6 km a+1) off the Gujarat coast. The Western Ghats help to increase the intensity of the rainfall. Even the setting in of the monsoon along the west coast as well as in the Bay of Bengal is guided by low pressure areas over the Arabian Sea and the Bay of Bengal, some of which develop into depressions and tropical cyclones.

The activity of the north-west monsoon is similarly controlled by low pressure areas or depressions from the south Bay of Bengal moving westwards across the Tamil Nadu coast. Tropical cyclones in the pre-and-post-monsoon seasons cause widespread rains in the State. When there are no depressions



or cyclones in the south peninsula, there is failure of north-east monsoon rains with consequent distress.

Thus, the formation and movement of low pressure areas or depressions largely determine the activity of the monsoons all over the country and account for its vagaries. For making reliable forecasts of the monsoon rains over different parts of the country a correct understanding of the formation and movement of these depressions and low pressure areas is, therefore, essential, apart from a correct knowledge of the large-scale monsoon circulations themselves.

Forecast techniques

The basic techniques for forecasting monsoon activity are the same as for any other natural phenomenon. They consist of making observations of the initial state of the atmosphere, understanding the physical processes governing its subsequent development and determining its future during the forecast period. Since these developments do not take place uniformly with time, there is need to extrapolate or compute them for short intervals and integrate them over the longer forecast period.

The monsoons affecting India are parts of larger circulations over the globe extending over South Asia and

Africa and are linked with atmospheric circulations elsewhere, like the south Indian Ocean, the western Pacific Ocean, Eurasia etc. It is, therefore, necessary to collect reliable observations on a global scale at least for the Eastern Hemisphere. In the upper air, observations of winds and temperature are required up to as high levels as possible, say, 20-30 km, at least twice a day. Over the oceans, data on winds, weather, sea and air temperatures etc are necessary at frequent intervals. Forecast centres collect these data over large areas as quickly as possible, make three-dimensional analyses to prepare forecasts for desired periods using available physical and mathematical models. Although the physical processes are complicated and not well understood, facilities have been established in our country for global collection of data and analyses in collaboration with the weather watch (WWW) programme of the World Meteorological Organisation (WMO). A Regional Telecommunication Hub (RTH) and a Regional Meteorological Centre (RMC) of the WWW have been established at New Delhi by the India Meteorological Department (IMD) in recent years. A third generation scientific computer IBM 360/44 has been installed at the RMC in July 1973, and a Phillips telecommunication computer DS714 gifted by the Government of

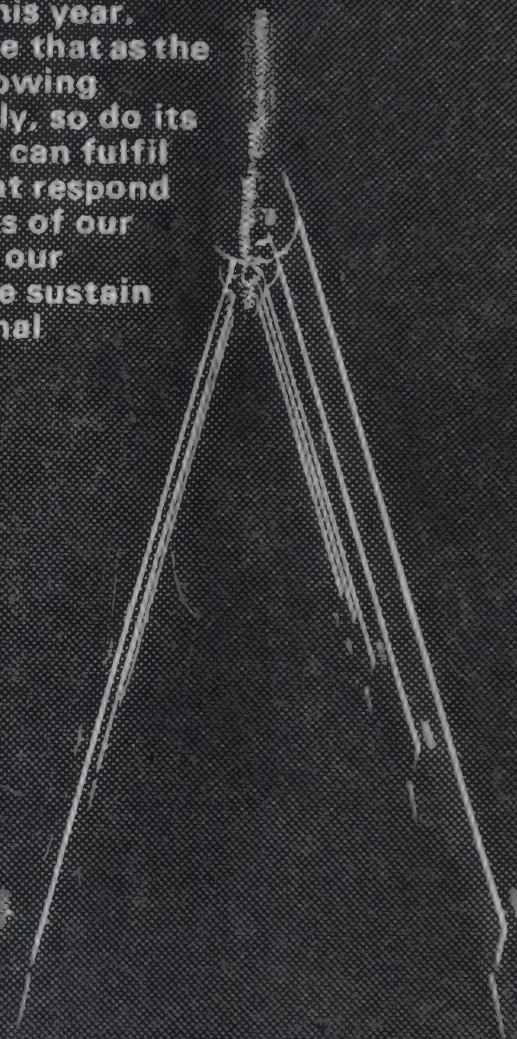
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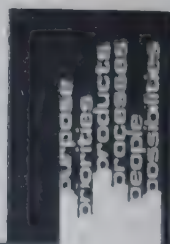
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Observational tools

The greatest lacuna for monsoon forecasting is the lack of observations over the vast Indian Ocean, the Arabian Sea and the Bay of Bengal wherefrom the monsoon picks up copious moisture for subsequent precipitation over land. Observatories established by the IMD on the land chains of Lakshadweep and Andaman-Nicobars provide valuable data daily. A few ships and aircraft over the sea areas supply meteorological reports from time to time. But on most days these sea areas remain blank on meteorological charts, and forecasters are obliged to take recourse to guesswork. Meteorological satellites orbited by the USA since 1960 and by the USSR since 1966 provide valuable information of cloud cover over oceans. By setting up ground

stations to monitor Automatic Picture Transmissions (APT) from orbiting meteorological satellites, meteorologists in the country have been enabled in recent years to keep watch on the development and movement of monsoon depressions and tropical cyclones over areas of sea and land. The latest meteorological satellites have been equipped with facilities to take a vertical temperature profile (VTPR) up to 50 km high at desired locations over the oceans and elsewhere. These data are most useful for meteorological analyses and are regularly obtainable through the WWW telecommunication channels.

There is, however, need to measure winds at various levels in the monsoon over the oceans. In connection with the Global Atmospheric Research Programme (GARP) organised by WMO and ICSU (International Council of Scientific Unions), techniques have been devised to deploy balloon-borne instruments released from large mother balloons drifting at 30 km up in the

atmosphere and to collect the data with the help of orbiting satellites.

A geostationary meteorological satellite located above the equator at 70 degrees E will be launched by the USSR in 1977-78 and will be able to keep a continuous watch over the development of the monsoon cloud formations over the Indian sub-continent and neighbouring seas, monsoon depressions and cyclones etc and to transmit pictures on command to earth stations at half-hourly intervals. By measuring the movement of identifiable clouds during short intervals, it is possible to estimate the direction and strength of winds over the ocean at the levels at which these clouds occur.

Over the land areas, necessary radiosonde (for temperature), radiowind and radar networks have been developed and are working in the country. Four radar stations along the east coast at Madras, Visakhapatnam, Paradeep and Calcutta and one along the west coast at Bombay have been set up in recent years. Each is capable of scanning up to 400 km round the station and can detect and track continuously cloud formations in association with monsoon activity, depressions and tropical cyclones in its area of surveillance. Forecasters can pinpoint these cyclones and give accurate warnings with the help of coastal radars.

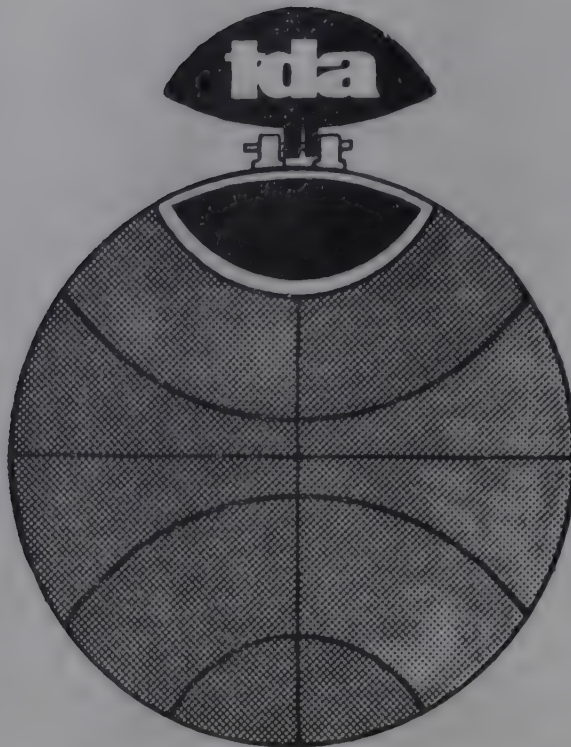
Forecast capabilities

Three types of forecasts of monsoon rainfall are needed for use of agriculture and other interests (i) short-range up to 1 or 2 days; (ii) medium-range up to 5 or 7 days; and (iii) long-range for the whole monsoon season:

(i) Short-range forecasts: Short-range forecasts are issued by IMD using conventional techniques of weather map analyses and prognoses by manual means, are disseminated to the public through radio and newspapers. Although they are highly subjective and depend largely upon the experience and intuition of the forecaster, such qualitative forecasts for fairly large areas comprising meteorological sub-divisions are quite reliable, and their accuracy may be 70-80 per cent. The accuracy is high during periods of well-defined and steadily moving systems like depressions and cyclones. When these systems intensify or weaken suddenly or change their course abruptly the forecasts are subject to failure unless the cyclones are within radar range. On most occasions, it is possible to indicate areas of flood producing heavy to very heavy rains, drought producing breaks in the mon-

Fig. 3. CO-EFFICIENT OF VARIATION OF MONSOON RAINFALL OVER INDIA





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and cyclones with a good degree of accuracy.

The same is, however, not the case in local forecasts over a city or a region due to the showery nature of monsoon precipitation. It is a common experience that a heavy shower occurs over one part of a city with little or no rain in other parts. The forecaster cannot pinpoint the occurrence of the shower with conventional techniques. Very useful information can, however, be provided to the public by scanning rainclouds approaching a city with a weather radar and broadcasting a running commentary of their movement over radio. It is possible to say which parts of the city are affected by rain and which are not. Such services exist in several developed countries for the benefit of urban complexes and can easily be set up in our country also with co-operation between IMD and AIR.

(i) *Quantitative Forecasts*: There is also a great necessity for quantitative forecasts indicating the amount of rain to be expected over concerned areas. It is possible to attempt such forecasts by Numerical Weather Prediction (NWP) techniques with the help of computers. Monsoon and tropical weather systems like ours present special difficulties in mathematical modelling as their physical nature is not fully known. Further research is, however, necessary to tackle this important problem.

(ii) *Medium range forecasts*: Except for the general outlook for three days indicated in farmers' weather bulletins, beyond the usual short-range forecast periods, no medium-range forecasts (MRF) are issued in our country. These outlooks are dependent on the subjective anticipation of the forecaster. They usually succeed when a depression or a cyclone develops and moves in an anticipated direction. There is no mathematical or physical basis for these outlooks except some reliance on persistence and climatology. Disturbances far away from the forecast area generally move into and affect the forecast during a period of five to seven days. It is, therefore, necessary to analyse meteorological data over a very wide area on a hemispherical scale in order to attempt MRF. Further research is needed in this direction making use of global data and computers available in the country.

(iii) *Long-range forecasts*: Forecasts of normal, above normal or below normal rainfall over large areas like north-west India and the peninsula bas-

ed on statistical correlations with meteorological variables over different parts of the world are issued by IMD on June 8 and updated on August 8, every year. Although these forecasts have been issued for more than five decades, their utility is limited since the user is interested in his restricted area and not in a large area comprising four or five States. Excessive rainfall released in one State may compensate a deficit in another and average out into a 'normal' forecast for the whole area! Recent researches in different parts of the world have highlighted the importance of physical factors like ocean temperatures and solar bursts, apart from large-scale atmospheric circulations. The ocean-atmosphere system is coupled, each supplying energy and interacting with the other. The ocean is slow in abstracting energy from the sun and also in giving it out to the atmosphere. Hence, oceanic parameters are considered to give a better indication of long-range weather changes than atmospheric factors alone.

It is also becoming increasingly evident that rainfall at many stations in the world is affected by solar activity. For example, it is seen that the monsoon rainfall along the west coast of India north of Mangalore steadily rose from the years 1900 to 1957 along with the corresponding increase in sun-spot activity and started decreasing thereafter (fig. 4). No long-term trends and periodicities of rainfall are describable at other inland stations. Rainfall at Trivandrum and Cochin and a number of other places seems to respond to 11-year sun-spot cycles.

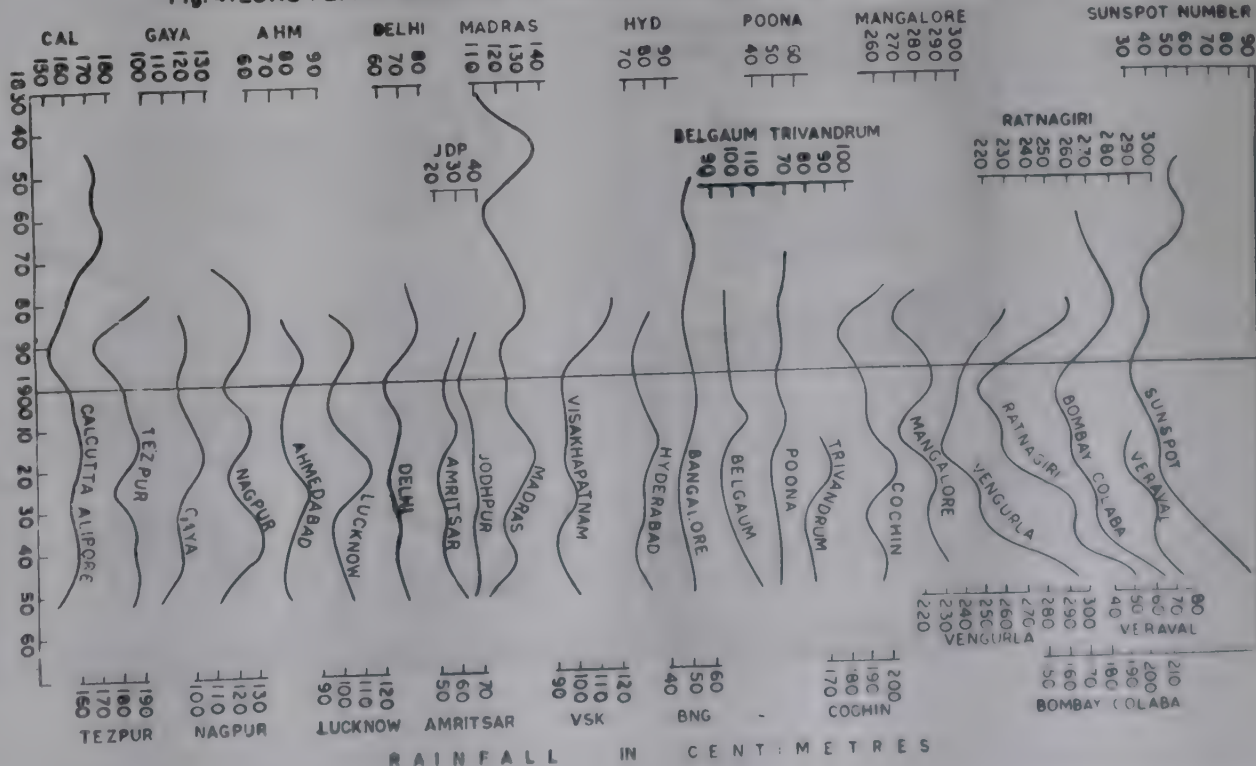
A variety of other factors like heating of the Tibetan plateau which pro-

vides energy to the upper air anti-cyclone overlying the monsoon circulation, effects of the circumpolar cold vortex on the monsoons, interhemispheric coupling with circulations in the Southern Hemisphere, surface high pressure in the central Pacific Ocean and types of activity in the western Pacific as well as the oceanographic and solar parameters mentioned above should be taken into account in any formulation for LRF.

Long-term climatic changes

In recent years some western meteorologists predicted failure of the Indian monsoon after the disastrous drought of 1972. They drew a parallel with the persistent drought over the Sahel region south of Sahara in Africa and attributed it to a slight cooling trend that has been noticed in the polar regions after 1940. We did not agree with this alarmist view particularly in view of the stabilising influence of the Tibetan plateau both in providing heat energy for the upper air circulation during the monsoon season and in acting as an effective barrier against cold air outbreaks from polar latitudes. Our analysis of long periods of data in India did not show any downward trend over Rajasthan. While prolonged droughts are not uncommon in Sahel, the south-west monsoon has seldom failed all over India at any time during the past 100 years. The exceptionally good monsoon of 1975 should have belied such dire expectations! I would, however, sound a note of warning that there is no scope for complacency. Considering the annual fluctuations in monsoon activity, pockets of drought should be expected

Fig. 4. LONG PERIOD VARIATION OF ANNUAL RAINFALL AT DIFFERENT STATIONS IN INDIA



in a few areas of the country next year and thereafter.

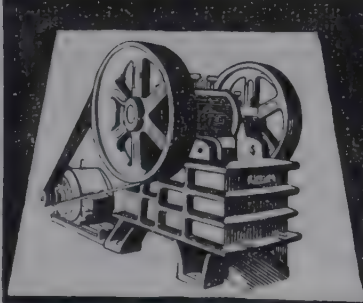
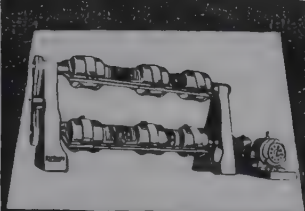
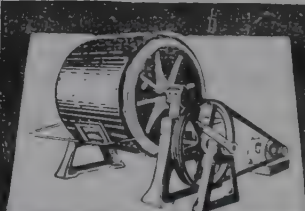
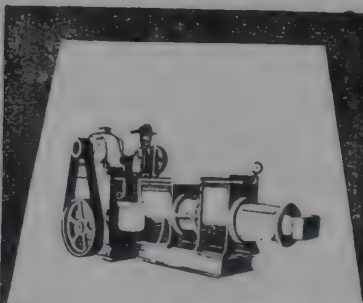
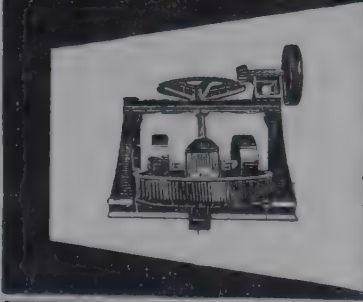
Further research and development

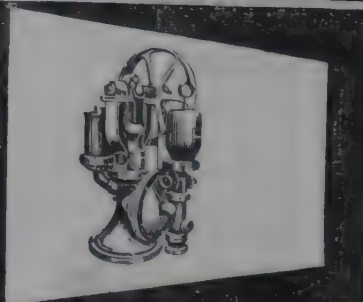
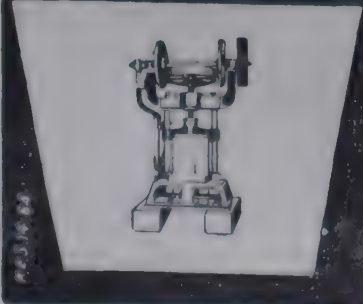
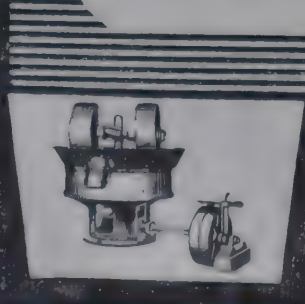
It is obvious that although considerable research has been done in monsoon meteorology by Indian and foreign meteorologists, much more remains to be done. This can be achieved only through international collaboration using facilities of a number of nations interested in the monsoon problem. In 1963-66, India actively collaborated in an International Indian Ocean Expedition (IIOE) initiated by the USA, using ships and aircraft to take oceanic and meteorological observations over the Indian Ocean and the Arabian Sea. Many useful results were obtained for the first time about the structure of the monsoon over the Arabian Sea. In 1970 we had proposed at the GARP planning meeting at Brussels the imperative need to incorporate a monsoon experiment (MONEX) as an integral part of GARP. This has been accepted and two planning meetings of experts have taken place in 1973 and 1974 at Yerevan (USSR) and Singapore. MONEX is to take place in 1978-79 as part of FGGE (First GARP Global Experiment) using a large number of ships, buoys, aircraft, balloon-borne instrumentation, orbiting

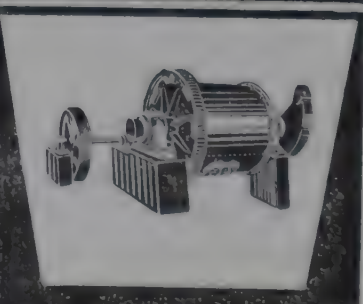
and geostationary satellites, etc. This will be a multi-national effort costing a few hundred million dollars for all the participants. In our own interest it is necessary that India takes an active, if not leading part in MONEX through the appropriate scientific agencies. As a preliminary to MONEX, we had organised an Indo-Soviet Monsoon Experiment (ISMEX) during the monsoon of 1973, in which four highly instrumented oceanographic vessels of the USSR and two of India took part over the Arabian Sea and the equatorial Indian Ocean. These observations extended to 30 km in the atmosphere and to depths of one km in the ocean. Preliminary research by both participants has provided some definite results of the structure of the Arabian Sea monsoon. A similar experiment next year will be useful before the International MONEX. When the observations of ISMEX and MONEX experiments are fully processed and the monsoon phenomena are understood with a fair degree of accuracy, they would undoubtedly add considerably to our knowledge of the large-scale monsoon circulations as well as the monsoon depressions and low-pressure areas. This would, in turn, enable Indian meteorologists to issue reliable short, medium and long-range forecasts for

the farmers and other user interests the country with the help of global data of WWW and computer processes by the end of the decade.

Though there is no fear of any large scale diminution of monsoon activity over the country in the coming decade attention should be drawn to the downward trend in monsoon rainfall that has set in along the Bombay coast after the peak rainfall (and sun-spot) year of 1957. There was 30 per cent increase in mean annual rainfall from 1900 to 1957. If a similar decrease occurs during the next 50 years along with a corresponding increase of population and water use for industries, agriculture and human consumption, there is cause for concern at the beginning of the next century. A simple and feasible solution will be to start conserving the heavy monsoon rainfall over the Ghats by constructing a chain of artificial lakes and reservoirs over the hill ranges. This would be beneficial not only to urban complexes like Bombay, but also to Maharashtra, Andhra Pradesh and Karnataka east of the Ghats. A similar artificial water reservoir programme over the Eastern Ghats would go a long way in relieving present and future scarcity of water in Rayalaseema and the north coastal districts of Andhra Pradesh and inland districts of Orissa.



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Land and water management problems indivisible

By B. B. Vohra

SENSIBLE water policy should concentrate on the conservation, to the maximum extent possible, of water as soil moisture and ground water rather than, as is happening now, on the storage of silt-laden waters in gigantic reservoirs and on the construction of extensive works for containing floods which are uncontrollable because they are bound to increase in fury with each passing year if their catchments continue to be neglected.

The rich dividends which a sensible water policy—sensible because it takes account of the realities of the relationship between land and water—and is not based on a purely engineering approach—would pay are easy to set out. Precious soil resources would be saved for the community—it has been estimated that the amount of soil which is displaced as a result of water erosion is of the order of 6,000 million tonnes annually and contains nutrients equivalent to 5.37 million tonnes of NPK. Floods, which cause losses of the order of Rs 300 crores annually, would be reduced in incidence and severity. The danger posed to tanks and reservoirs—on which thousands of crores have been invested—by sedimentation would be removed. Finally, a great deal of water which is being lost to the sea would be conserved as groundwater.

Ground water vs. surface water

The benefits which additional supplies of groundwater would confer on the community need special mention. For not only does this resource represent water in its purest natural form, but it also costs absolutely nothing to store for indefinite periods and what is more, to convey over the large distances which it travels under the surface of the ground in an effort, as it were, to serve the largest possible number of people at their very doorsteps. Further, it suffers no losses by evaporation or seepage—either during storage or during transmission—such as sur-

face waters are subject to. It is easy to tap as individual tubewells can be installed at little expense and within a matter of weeks if not in fact days. Once developed, ground water is available as and when required by the user on the mere pushing of a button and therefore lends itself beautifully to the requirements of modern agriculture.

By contrast, surface water is extremely difficult to store and manage. Big projects—such as are in vogue in this country—take decades to design and build, require large areas of precious land for submergence and for distribution systems, are subject to serious evaporation and transmission losses, and demand stupendous outlays for their completion. They also create significant problems of water-logging and drainage and thus pose a threat to the very land they are meant to serve. Their storages are exposed to the threat of siltation and their command areas require large outlays for the full development of their potential. They require large staffs for maintenance and operation but find it difficult to give full satisfaction to the farmer in the matter of supplying water as and when required. Financially such projects are still in the red—the annual losses on their operation are of the order of Rs 150 crores. But above all, they are wasteful of water—not only do transmission losses amount to around 40 per cent on the average but since water is generally not charged for on a volumetric basis, the farmer is also extravagant in his use of this resource.

For all these reasons, every effort must be made to replenish groundwater resources to the fullest extent possible.

Push button irrigation

It is not a mere accident that the Green Revolution should have first taken root in precisely those regions—the alluvial plains of the North West and the deltaic plains of the South—where groundwater is not only most readily available but has also been tapped for irrigation to the greatest extent. For if there is one thing which the new high yielding varieties and multi-

ple cropping patterns demand more than anything else for their success, it is water—water at the right time and in the right quantity. This is a requirement which can be met only by a source of irrigation that is completely under the farmer's own control—no surface irrigation system can even remotely hope to compete with groundwater in this respect. That the farmer has not been slow to appreciate the advantages of the "push button" irrigation made possible by a pump set or tubewell of his own is brought out vividly by the following figures:

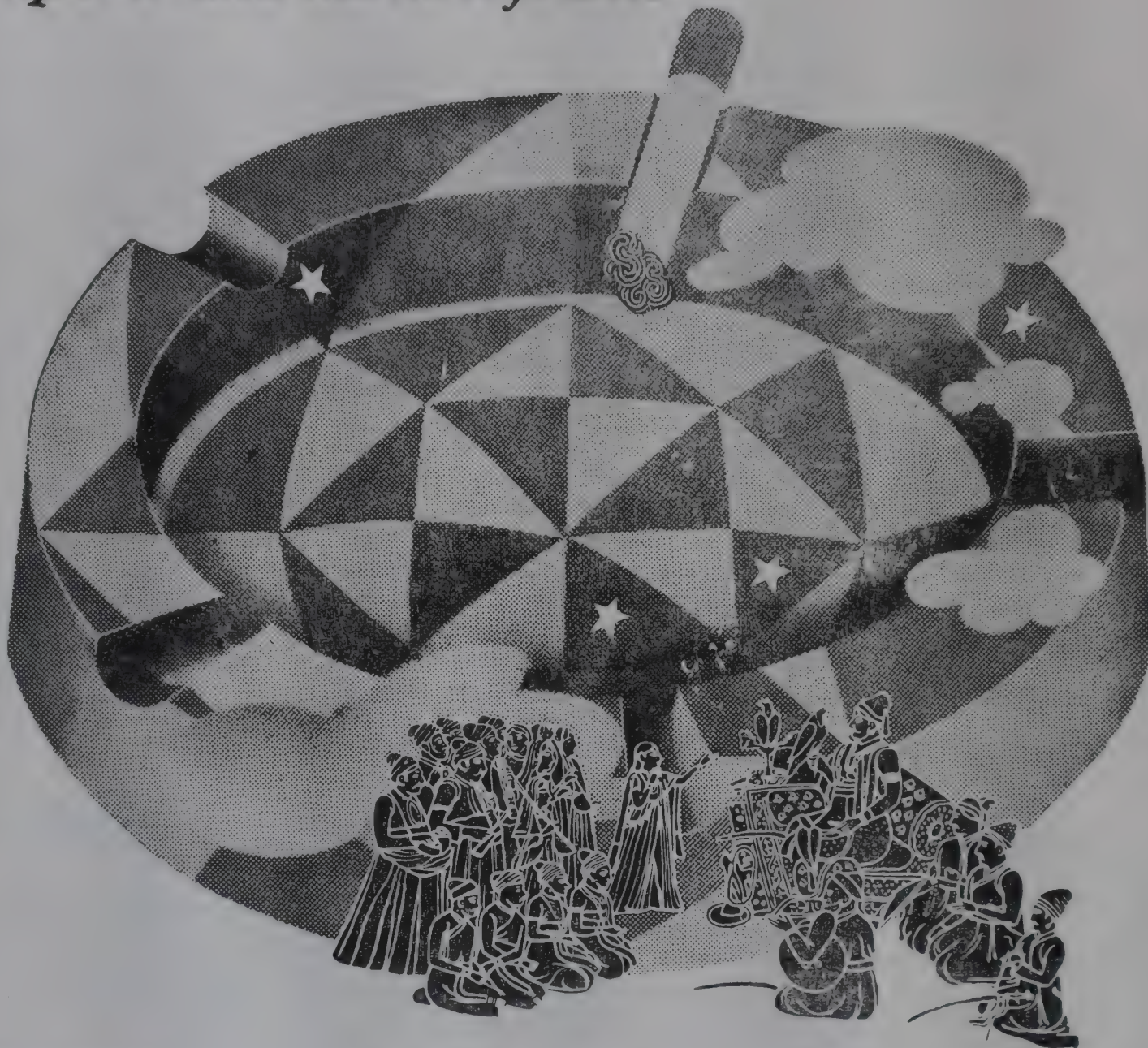
	(In thousands)			
	1950	1965	1969	1971*
No. of private tubewells	3	100	279	470
No. of diesel pumpsets	66	471	837	1150
No. of electric pumpsets	19	513	1084	1620
Total	88	1084	2196	3240

* Estimated.

This truly explosive growth could not have been achieved but for an extraordinary combination of circumstances. The nation-wide drought and near-famine of 1965-67 compelled attention not only to the existence of ground water, in greater or lesser degree, over large parts of the country, but also to the need for developing this resource. The almost simultaneous arrival on the scene of high yielding varieties of wheat and rice, and the introduction of an incentive-oriented price policy by Government lifted Indian agriculture out of a long spell of stagnation at almost one stroke and made investment in farming—and therefore in ground water also—attractive for the first time in living memory. At the same time the growth of indigenous rig, pump and pipe manufacturing industries and the spread of rural electrification and rural roads brought the installation and operation of tubewells and pump sets within the reach of an increasing number of farmers. Finally, mention must be made of the very wise and far-sighted decision of Government to provide,

Mr Vohra is Additional Secretary in the Union Ministry of Agriculture and Irrigation.

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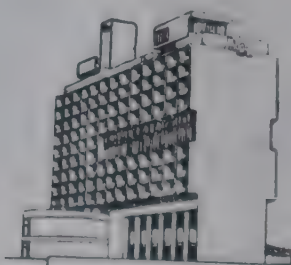
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a really massive scale, for loan
nce for on-farm ground water
elopment.

y attitudes

The feasibility of on-farm ground
er projects is matched by their pro-
bility. A well or a tubewell takes
le time to construct, begins to ope-
e as soon as it has been completed
d starts yielding returns within a
gle crop season. These returns are
e not only to the efficient irrigation
hich becomes available to the farmer
t also because he is induced to take
ertain other steps which contribute to
tter farming. Having sunk his own
oney in the project, and knowing that
e will have to bear the full cost of
operating it, the farmer is naturally
xious to make the best use of his
vestment. This impels him to carry
ut land levelling and other on-farm
mprovements with the maximum ex-
pedition and at his own cost as well
s to use fertilisers and other inputs in
he recommended manner. As a result,
e achieves significantly higher yields
ight from the very first crop after the
ompletion of his project. Is it any
wonder that the farmer should have
opted for ground water as decisively
as he has?

Indeed, the initiative taken by mil-
lions of farmers and the managerial role
played by them in the execution of
their own small projects lie at the very
heart of what may be called the Ground
Water Revolution. But for this role,
it is inconceivable that a total invest-
ment of Rs 2,000 crores could have been
possible in this field during the last two
decades or that the rate of such invest-
ment could have reached the level of
about Rs 250 crores a year since the
end of the Third Plan. It is significant
that over 90 per cent of this investment
has taken place in the private sector
and less than 10 per cent in the public
sector represented by State tubewells.
Private investment has not only meant
reduced overheads and costs but has
also contributed to speedy and efficient
execution. What is perhaps of still
greater significance is the fact that pri-
vate enterprise and management in this
field has made the farmer more self-
reliant and self-confident than he has
ever been and therefore a more efficient
producer. There is a world of difference
between the attitudes and mental pro-
cesses of the farmer who has to wait
for the rains or canals to bring water to
his fields and the farmer who knows that
he can irrigate his land exactly when
he likes from a project which he has
himself planned and executed. And it

is only the farmer who has got out of
a passive and fatalistic frame of mind
who can plan aggressively for the
future and act boldly and confidently
in the pursuit of greater prosperity.
Here then is another link between the
Ground Water Revolution and the Green
Revolution.

According to all indications there
are no signs of any slackening in the
tempo achieved in ground water devel-
opment during recent years—if any-
thing, the rate of growth might in future
even exceed what has been registered
in the past. While this is a prospect
which is pregnant with exciting possi-
bilities, it is also fraught with a great
danger—the danger that a rapidly devel-
oping situation may out-strip even a
proper understanding of it, let alone the
ability to deal with it adequately. In-
deed such a state of affairs may, to a
large extent, be said to exist already
considering that the scale of ground
water development in the country today
is utterly unmatched by anything like
the technical, administrative and legal
arrangements necessary to ensure its
growth along healthy lines. Our pre-
sent state of unpreparedness is reflected
by the fact that the distress signals—
such as a lowering of water tables in
certain areas and the widening gap be-
tween the demand and supply of elec-
tricity in certain other areas—which
have appeared in this field recently
have failed to evoke sufficient response
from the authorities. This is mainly
because the “concerned authorities”
just do not exist as yet or at least do
not exist in a sufficiently organised
form.

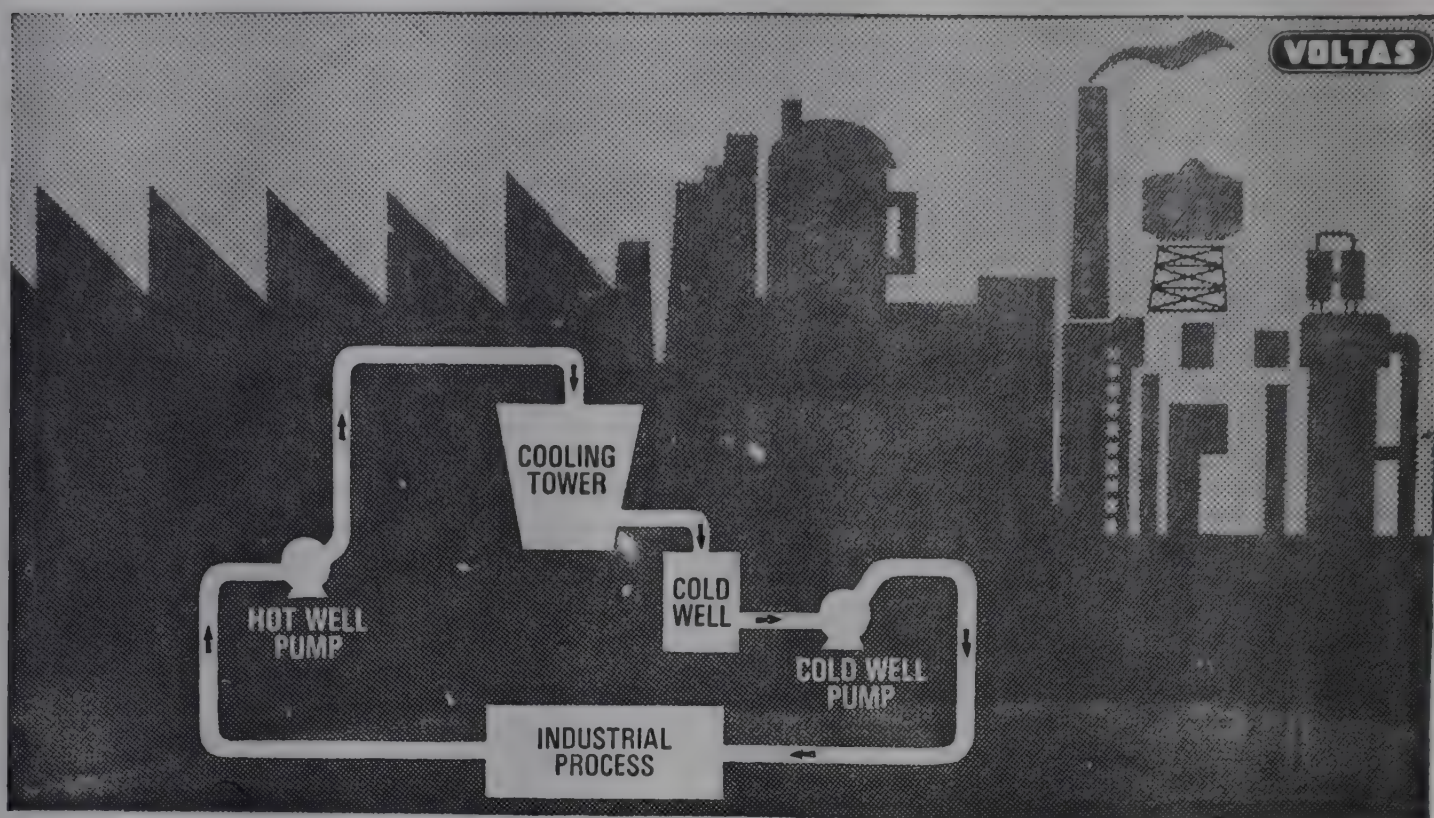
Most important source

It is time that ground water was
viewed in its correct perspective and
recognition given to the fact that it has
become, albeit quietly and without any
fanfare, the most important source of
irrigation today. Even a cursory glance
at the relevant figures should be enough
to demolish the habit of thought that
persists in relegating ground water to
a position of minor importance in the
field of irrigation, however great the
justification for doing so might have
been 20 or even 10 years ago. In the
Fourth Plan the total investment in
ground water development has been
placed at Rs 2,000 crores, inclusive of
an outlay of about Rs 750 crores in rural
electrification which is aimed primarily
at the energisation of pump sets and
tubewells. The corresponding figure
for surface water development is
around Rs 1,100 crores only

Again, according to the latest avail-
able figures (1967-68) tubewells and
wells between them account for 33.7 per
cent of the net area irrigated by differ-
ent sources; Government canals account
for 37.3 per cent while irrigation from
private canals, tanks and other sources
make up the remaining 29 per cent.
However, the concept of the net irri-
gated acreage bears little relevance to
the efficiency with which irrigation is
carried out and it is the efficiency of irri-
gation which governs the productivity
of water as an agricultural input. If
the yardstick of productivity is applied,
there can be no manner of doubt that
ground water is today the single most
important source of irrigation.

It is also necessary to realise that
this position of pre-eminence is not likely
to be lost. For, as our knowledge of
our ground water resources improves
and as drilling and pumping techno-
logies advance, so will our capacity to
manage and exploit these resources also
increase. In this connection it is perti-
nent to note that “ground water accounts
for more than 95 per cent of all the
liquid fresh water available on the
earth at any given moment.” In the
USA, ground water resources have been
estimated to “contain far more fresh
water than the capacity of all the
nation’s reservoirs and lakes, including
the Great Lakes. It has been estimated
that the total useful ground water
in storage is of the order of 10 years
annual precipitation or 35 years’ run off”.
There is little reason to doubt that our
own ground water reserves will bear
a similar relation to rainfall, surface
flows and reservoir capacity. The
future therefore undoubtedly lies with
ground water.

The preference of the farmer for
ground water irrigation has been
noticed already. This preference is
based on the quality of service which
ground water provides, even though it
costs the farmer from between Rs 500
per irrigated acre in alluvial areas and
around Rs 2,000 per irrigated acre in
hard-rock areas by way of initial capi-
tal investment required to install a pro-
ject of his own and even though he has
thereafter to bear the cost of pumping
in full. It is however necessary to state
that it is also very much in the interest
of the community as a whole that the
natural advantages which ground water
enjoys should be taken the fullest ad-
vantage of. These advantages flow from
the fact that in the case of ground water,
a bountiful Nature has provided free
storage, free conveyance over large dis-
tances as well as freedom from loss by
evaporation and seepage both during



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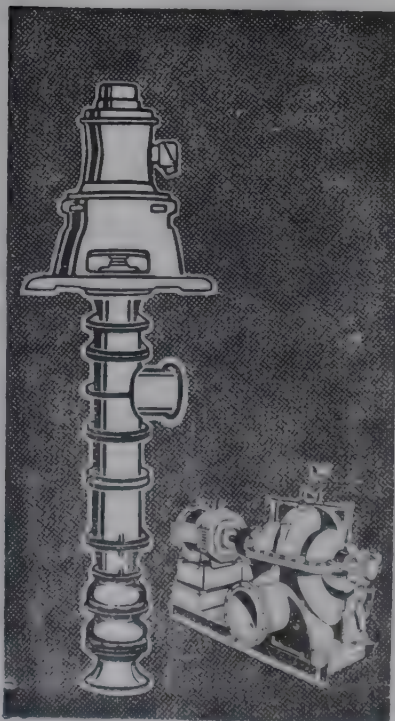
The FCI unit at Gorakhpur is no exception. The amount of water available was fairly small.

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orage as well as during conveyance. Further, groundwater storages are free from the hazards of pollution as well as siltation and can be tapped without requiring anything like the army of men needed to maintain and operate big surface storage and distribution systems. In fact, groundwater constitutes a vast natural grid of unrivalled efficiency and extent which it would be foolish not to utilise to the maximum.

Policy implications

In financial terms, all these natural advantages which groundwater possesses easily add up to over Rs 2,000 per acre of the area irrigated because this is what it costs, at present day prices, to acquire land for surface storage and distribution systems, to resettle rustees from areas of submergence, and to build dams and lined distribution systems which reach up to the farmers' field. (In this connection it is relevant to mention that losses from unlined distribution systems amount, on an average, to as much as 40 per cent of the water released from reservoirs and that almost all the 76 lakh odd acres which have been put out of commission by water-logging and which will require around Rs 700 crores to reclaim, owe their present condition mainly to the effects of seepage from unlined distribution systems and of irrigation from channels which are not equipped with proper control structures.)

This figure of Rs 2,000 per acre does not however take any account of the incomparably superior quality of irrigation from ground water sources or of the costs necessary to be incurred to prevent losses by evaporation and to save reservoirs from siltation. In addition, the submergence of land under reservoirs may, in certain cases, involve the loss of mineral resources, rich wild life areas and valuable historical sites—losses which by their very nature are difficult to quantify. It would therefore be obviously in the public interest to avoid taking up surface water projects wherever irrigation from ground water is technically and economically feasible.

Public interest also demands that the many disadvantages from which big surface irrigation systems suffer by virtue of their very size, should be avoided wherever this is possible. Big surface irrigation systems require years for investigation and planning, years for construction and more years to come to full fruition. This last disadvantage is particularly serious and springs from the difficulties inherent in preparing huge areas—sometimes upwards of a million

acres—for irrigated agriculture. These difficulties are compounded by the fact that irrigation projects are deemed to have been "completed" as soon as outlets have been provided in the distributaries to supply water to blocks of upto 500 acres each. Responsibility for the construction of water courses—which, in order to prevent seepage and permit proper irrigation, should be correctly aligned as well as lined and equipped with the necessary control structures—within the blocks commanded by each outlet is left undefined. Also left undetermined is the responsibility for levelling the land (so as to permit the application of water to fields in an even manner) on the basis of outlet commands and for providing drainage wherever this is necessary.

State Agriculture Departments, which may be expected to accept these responsibilities, are unfortunately seldom equipped to do so either organisationally or financially. As a result, these jobs remain untackled for long years during which the waters which have been impounded at great cost, remain improperly utilised. The loss of natural resources which this state of affairs represents is something which the country clearly cannot afford. The nation can also not afford the sizable financial losses which big irrigation projects incur year after year. Mounting interest charges on investments in long gestation schemes, increased costs of maintenance and operation and the reluctance of State Governments to revise irrigation rates are together responsible for a total annual loss of the order of Rs 80 crores.

Planning on catchment basis

Turning to the general question of all types of water sources, it is generally agreed that the planning of water conservation and use would be undertaken on a sub-catchment basis, in order to ensure that the water which flows into the main river system from each of its sub-catchments is not only free from silt but is also such as is genuinely surplus to local requirements. The calculation of local requirements would naturally depend upon the land use which is considered to be the best for the area in question and would involve a study of local soils, climatic conditions and available water resources. Arid areas should, in particular, not allow any run off to be lost and must utilise all precipitation locally—whether for growing crops or merely grasses and trees. Protection against over-grazing and over-felling must, in all sub-catchments, be undertaken alongside

such measures as contour ploughing, contour terracing and bunding and the construction of gully plugs and detention weirs.

It is not difficult to imagine the dramatic change that the implementation of such an approach would bring about in the ecological environment that governs our fate as a nation. The denuded Shivaliks, the ravines along the Chambal, the Jamuna, the Sabarmati and the Mahi would become things of the past, as would be treeless and grassless slopes of the Deccan plateau and the bare hills of North Eastern India which have been stripped of vegetation by imprudent shifting cultivation. The millions of hectares of the so-called waste lands which yield nothing but silt and floods today would become important producers of grasses and trees and would contribute significantly to the replenishment of the country's groundwater resources. Our rivers would carry less sediment, and thanks to return flows from groundwater aquifers, would maintain more even flows throughout the year. Our storages would acquire new leases of life and the severity of both floods and droughts would be reduced.

Better utilisation of existing projects

All this can however become possible only if the management of our water resources is not looked at as a problem of civil engineering but as something inseparable from the total management of our land and soil resources. If this is done the conclusion will soon be reached that the first task before our irrigation departments today is to make the fullest possible use of the waters which have been already impounded at such heavy cost as this offers the best hope to the country for achieving self-sufficiency in food in the shortest possible time. This is however a task which requires a drastic reorientation in the attitudes of the irrigation engineer.

Instead of dreaming of building more gigantic structures he must learn to pay attention to the detailed requirements of efficient irrigation and undertake the execution of the numberless small works which are required in each command to maximise production, and to prevent the wastage of water as well as damage to the soil. To illustrate, distribution systems need to be extended in a scientific manner over tens of millions of hectares so as to reach the last field in each outlet command, fields need to be levelled and reshaped in accordance with the contours of the land, and field as well as



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intermediate and major drainage provided wherever water-logging is or is likely to become a problem. A comprehensive approach to irrigation problems would also induce engineers to take more than a theoretical interest in the protection of reservoirs against siltation and would involve them seriously in soil and water conservation measures in catchment areas. All these are extremely complicated tasks and present a very big challenge indeed. They will also require huge outlays, running into thousands of crores and will take decades to complete.

Production potential

It has been estimated that the productivity of the water which is being presently applied to the land by irrigation can be increased by at least 100 per cent, if irrigation systems and methods could be modernised and brought into line with soil and crop requirements and if wastages by seepage and by over-application of water could be avoided. It would be worthwhile to make such an effort because, in the ultimate analysis, the intolerable pressures to which large areas of our marginal and sub-marginal lands are being subjected by being placed under agriculture, can be relieved only if we are able to significantly increase the productivity of our better-placed irrigated lands. A little calculation will show that even if an average production of no more than 3 tons per hectare of foodgrains could be achieved on all our "irrigated" lands, these alone would be able to produce all the food that the country needs today, and therefore release large portions of the remaining 100 million hectares or so which are under unirrigated agriculture for being put to more rational and profitable uses. Among these uses would be a vastly better animal husbandry based on richer pastures and improved strains of cattle, sheep and goats, very much more forestry and very much more horticulture—all of which would be consistent not only with the objective of getting the most out of the land for our impoverished and growing population but also of conserving and improving the soil.

A programme for the better utilisation of our irrigated lands must therefore be taken up as a matter of the highest priority. Such a programme would, in turn, have to give priority to the commands of big irrigation projects because it is in these areas that there is the greatest scope for improvement. The first ingredient of such a programme would be the improvement of water delivery arrangements beyond the "out-

let" in the distributary. This is so because the responsibility of Irrigation Departments ceases at the outlet and it is the farmer who is supposed to make arrangements, in concert with other farmers in the block—which may range from about 50 hectares to 200 hectares in size—served by the outlet to construct and maintain water courses. Experience has shown that such arrangements vary a great deal from place to place. Over vast areas, aggregating to something like 2 million hectares, water courses have yet to be built by farmers although the main distribution systems have been completed by Irrigation Departments who have since departed from the scene. In such areas there is no irrigation at all, in spite of water being available.

In many other areas, where paddy is the only crop, irrigation is carried out by the "flood" or field-to-field method without the use of any water-courses at all—the resulting waste of water can be easily imagined. In the remaining areas there are *Katchha* water courses which are wasteful of land as well as of water, are difficult to keep in good order and do not lend themselves to controlled irrigation. If efficient irrigation is to be achieved, properly aligned and lined water courses which are

equipped with *pucca* structures capable of delivering water to each field in the command of the outlet are an inescapable necessity. However this would be a near-impossibility so long as the number of fields remain unduly large on account of fragmentation of holdings. The consolidation of holdings at least within the command of each outlet is therefore a prerequisite for efficient and economic irrigation. Such a process of consolidation will however require close co-ordination between the Irrigation and the Revenue authorities as well as, of course, the co-operation of the people.

Another ingredient of the programme is the levelling and shaping of each field so that it may be possible to apply water to it in a uniform manner and without waste. A fourth ingredient is the provision of drainage facilities wherever these are necessary to prevent water-logging and salinity. However, as has been already explained, drainage facilities must be provided in a comprehensive manner over fairly large areas so that the planning and execution of the major and medium drains may keep pace with the construction of field drains.

As far as the remaining irrigated areas—approximately 24 million hec-

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res—are concerned, these too would require attention but on a much smaller scale than the commands of major and medium projects. It is envisaged that these areas would require little or no levelling and drainage facilities. However, improved water delivery systems would be required even in these areas. In the case of on-farm groundwater projects, pucca water courses or under-ground delivery systems have proved to be extremely useful in improving the quality of irrigation.

Policy suggestions

Against this background, the broad features of a water policy which might suit our circumstances would appear to be somewhat as follows:

- (i) All land and water management problems must be viewed as a whole, as they do constitute an indivisible whole and cannot be considered in isolation from each other. Soil erosion, denudation, droughts and floods are all symptoms of the same disease of poor land and water management.
- (ii) The natural unit for the planning and execution of all land and water management pro-

grammes is the sub-catchment which must retain for local use all the water which it needs. It is only if this principle is adhered to that it will be possible to build up rational River Basin Plans on the basis of plans for each of the sub-catchments within the basin. Needless to say, such River Basin Plans will deal with land use matters as well as with the use of ground and surface water resources and the prevention and control of floods.

- (iii) The conservation of water to the maximum possible extent must obviously be worked for. It must be realised however that this is possible only if the conservation of the soil is achieved as a pre-requisite. The prevention of erosion by water must therefore form a cornerstone of any water policy.
- (iv) Since water is best and most conveniently conserved in the form of ground-water, high priority must be given to the replenishment of groundwater resources by natural as well as artificial measures.

(v) The maximum possible development of groundwater must be aimed at in view of the unique natural advantages offered by this resource. All the administrative, technical, financial and legal measures necessary for this purpose must be adopted as a matter of priority and the care of this resource should not be neglected any longer.

(vi) There is great scope for improvement in the working and utilisation of the potential of existing and on-going surface irrigation projects, and therefore for a quick increase in our agricultural production. Priority attention must accordingly be given to the investigation of shortcomings in each project and thereafter to their rectification. Steps must also be taken to make each project financially viable.

(vii) New surface irrigation projects must be investigated with great care and steps taken to avoid the mistakes noticed in the planning and execution of similar projects in the past.

(viii) Land and soil are our most precious non-renewable resources and must on no account be allowed to be damaged by water in the form of floods or water-logging.

(ix) Water must be used with the utmost economy, whether for agricultural, industrial or domestic purposes. It must also be protected against pollution by agricultural, industrial or municipal wastes. Recycling techniques must be investigated and adopted wherever possible.

(x) The problems of water management are, by their very nature, not such as can be tackled by any single discipline. All the disciplines concerned with good land and water management should be brought together under new integrated Departments of Land & Water both at the Centre and in the States.

(xi) Water is a national asset and must accordingly be placed in the Concurrent List in our Constitution.

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Fig. 1. An irrigation channel washed away by rain due to improper design in Dharwar district, Karnataka. Inadequate design of drop structures was the main cause of the damage. (Note the concrete slabs which formed the structure.)



Farm water conveyance and distribution

By A. M. Michael

PLANNED development of water resources, efficient methods of conveyance and distribution of water on the farm, judicious methods of water application, proper soil management practices and cropping patterns for high water use efficiency, scientific timing of irrigation according to the developmental rhythm of the plant and the removal of excess water are important aspects of a comprehensive irrigation development programme for increased agricultural production. Till recently, our attention in respect of irrigation has been confined mainly to the canal outlet where the water is delivered. On-farm water management has often been neglected. One deficiency is the design of on-farm distribution and drainage systems between farm fields. Storage and diversion dams, the canal network and main drains may be well engineered, but the water courses and farm water distribution systems are often inadequate and uncared for.

A large portion of the water harnessed at a high cost, through the canal

irrigation network or through wells and pumps, is lost by seepage from unlined carrier systems, comprising the main canal, branches, distributaries, water courses and field channels. In permeable soils like sand and sandy loam, the losses in earth channels are heavy. The loss in the field distribution system is even more significant in areas irrigated by wells as the unit cost of developing the resource is high.

Water losses in water courses and field channels may occur by seepage, by breaches along the channel through rat holes, by ponding of water in depressions and irregularities in the channel sections and by evaporation. The loss by seepage depends on the length of the water course, its wetted perimeter and the permeability of the strata through which the channel passes.

Estimates on conveyance loss of water: Kennedy¹ (1881) showed that on the Bari Doab Canal in Punjab about 47 per cent of the water entering at the head is lost by seepage (20 per cent in the main canal and branches, 6 per cent in distributaries and 21 per cent in water courses). Observations by Malhotra² (1970) showed that about 25 per cent of water admitted through a

canal outlet is lost in a 1.6 kilometre length of the water course in the Hissar Bhakra Canal Circle. The Second Irrigation Commission (1972), Government of India, has estimated that in the Indo-Gangetic plains the loss by seepage in the main canals and branches, distributaries and minors and water courses are 17 per cent, 8 per cent and 20 per cent, respectively. There is further loss in the field channels which are often substantial. Estimates of the United States Department of Agriculture (Agriculture Yearbook, 1955) indicate that about 20 per cent of the water entering a water course carrying 30 to 150 litres per second is lost by seepage in a length of 1.6 kilometres. The seepage loss for different types of soil as given in the above publication is as follows:

Type of soil	Seepage loss in cubic metres per second per million square metres of surface area
1. Ordinary clay soil ..	1.75 to 2.64
2. Sandy soil ..	5.30 to 6.18
3. Gravelly soil	10.61 to 21.22

1. From Naegamvala, J.P. (1972) *Economics and Problem of Lining Water Courses and Field Channels*—unpublished report submitted to the National Agricultural Commission.

2. Malhotra S.P. (1970) *The Untold Story of water courses in Hissar Bhakra Canal Circle*, Booklet. II p.

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Fig. 2. A brick-lined rectangular channel in Ferozepur district, Punjab. Lining not only saves water by eliminating seepage, but ensures equal distribution of water to all farmers sharing water from a canal outlet. The raised bed increases the command area of the water course.

The above figures highlight the huge loss of water in the conveyance system. This water, if saved, could be used to irrigate additional area which would increase the agricultural production substantially.

Surface channels

Farm irrigation distribution systems can be classified into two groups: surface channels and underground pipelines. Facilities for the conveyance and control of irrigation water are different for each type. Field channels may be unlined earth channels or lined channels.

Earth channels: Unlined earth channels are frequently used in water conveyance on the farm. The low initial cost constitutes the major advantage of earth channels. Poor design and lack of maintenance lead to heavy loss of water and damage to fields. Earth channels should be built with stable side slopes and with banks strong enough to carry the required flow of water safely. They should have ample capacity to carry the design discharge at non-erosive velocities. Farm channels are designed using the Manning formula. The side slope should be flat enough so that the banks will neither cave in nor slide when they are saturated with water. Permanent irrigation channels should not have side slopes steeper than 1½ horizontal to 1 vertical. In stiff

clay, however, steep slopes up to ½ to 1 are possible. Loose sand should have flat slopes of about 2 to 1. Main water supply channels that are built up higher than the surrounding field level should have banks large enough so that they will not be damaged by seepage or by trampling. The natural slope of the land is usually the deciding factor in determining the channel bed slope. The steeper the channel, the more will be the velocity and more the discharge for the same cross-section. But excessive gradients produce very high velocities which cause erosion. Normally, a channel should slope about 0.1 per cent. Silting may take place in the channel if the slope is less than 0.05 per cent. For determining the bed slopes of channels the velocities should be checked and the maximum grade designed so that the velocities do not exceed safe limits. Where earth channels are to be used on steep slopes, it is necessary to control the gradients and thus the velocity by constructing drop structures or by building up the channel bed.

Lined channels: The lining of channels will overcome or minimise the loss by seepage, prevent erosion in the channel, provide safety against breaks, retard moss and weed growth and provide control against damage by rodents or burrowing animals. Linings are helpful in reducing the amount of land

occupied by channels. Labour requirements for channel maintenance are substantially reduced. Concrete and brick or stone masonry are commonly used for lining irrigation channels. A well mixed and well made cement concrete lining and a single layer of bricks or stones laid in cement or lime mortar provide virtually waterproof channel lining. Limited use has also been made of bituminous mixtures, soil cement, chemical sealants, polyethylene film and impervious earth materials. Most of these are susceptible to damage by trampling by livestock, insects, weed growth and erosion by high velocity flows. Their short life often makes them uneconomical unless special protection is provided.

Concrete is used to a much greater extent for lining channels than any other material. When properly constructed, they give long service, with minimum repair and maintenance costs. Concrete linings may be placed in forms or may be applied as a plaster to the sides and bottom of the channel. A mixture of one part cement, three of sand and four or five parts of graded gravel of 1 to 3 cm size, makes a strong and durable lining. In alkaline soil, alkali-resistant cement should be used. A water-cement mix with 25 litres of water per bag of cement has been found to give good results. The linings should not be less than 3.5 cm thick. A wooden template made to fit the inside dimensions of the channel will be useful in obtaining a uniform cross-section of the lined channel.

Transverse contraction joints are used in concrete channel linings to control transverse cracking. Cracking results from shrinkage during volume changes caused by changes in temperature or moisture content. Spacing of transverse contraction joints to reasonably control cracking should be 2 to 3 metres. The lining is laid in lengths of 2 to 3 metres. Contraction joints are formed by constructing a vertical groove in the top third of the concrete.

Precast concrete structures form economical lining material for small and medium size farms. The channel sections can be made in a U-shaped wooden form by tamping in a concrete mixture made with a bare minimum of water. The size of the section will depend on the size of the irrigation stream to be conveyed. A concrete mixture of cement, sand and gravel in the ratio of 1 part cement: 2 parts sand and 3 parts gravel is suitable to make precast concrete channels, gates and pipes. Only the minimum quantity of water necessary

ke the mixture workable should be led.

For laying the concrete sections a stable small earth embankment is made. The embankment is compacted while moist and graded to obtain the desired bed slope. The precast concrete sections are then laid in straight lines. After laying the sections, their joints are filled with cement mortar (1 cement: 2 sand). It is necessary to wet the joints by sprinkling water frequently for 2 or 3 days or by ponding water in the newly laid channel.

A single layer of brick or tile or rubble stone may be used to obtain a satisfactory lining of field irrigation channels. The bricks, tiles or stones are laid flat on the compacted sides and on the bottom of the channel and the joints are filled with cement mortar. The mortar should have a cement-sand ratio of 1:3. The choice between brick, flat clay tile or stones depends mainly on their availability and relative costs.

Brick-lined irrigation channels could be either rectangular or trapezoidal. The trapezoidal section gives better hydraulic efficiency. But this section would occupy a larger area of land for forming the channel sides. The cost of compaction of the earth fill to lay the sides of the channel will be higher. It has been observed that the chances of trespass by cattle and consequent dam-

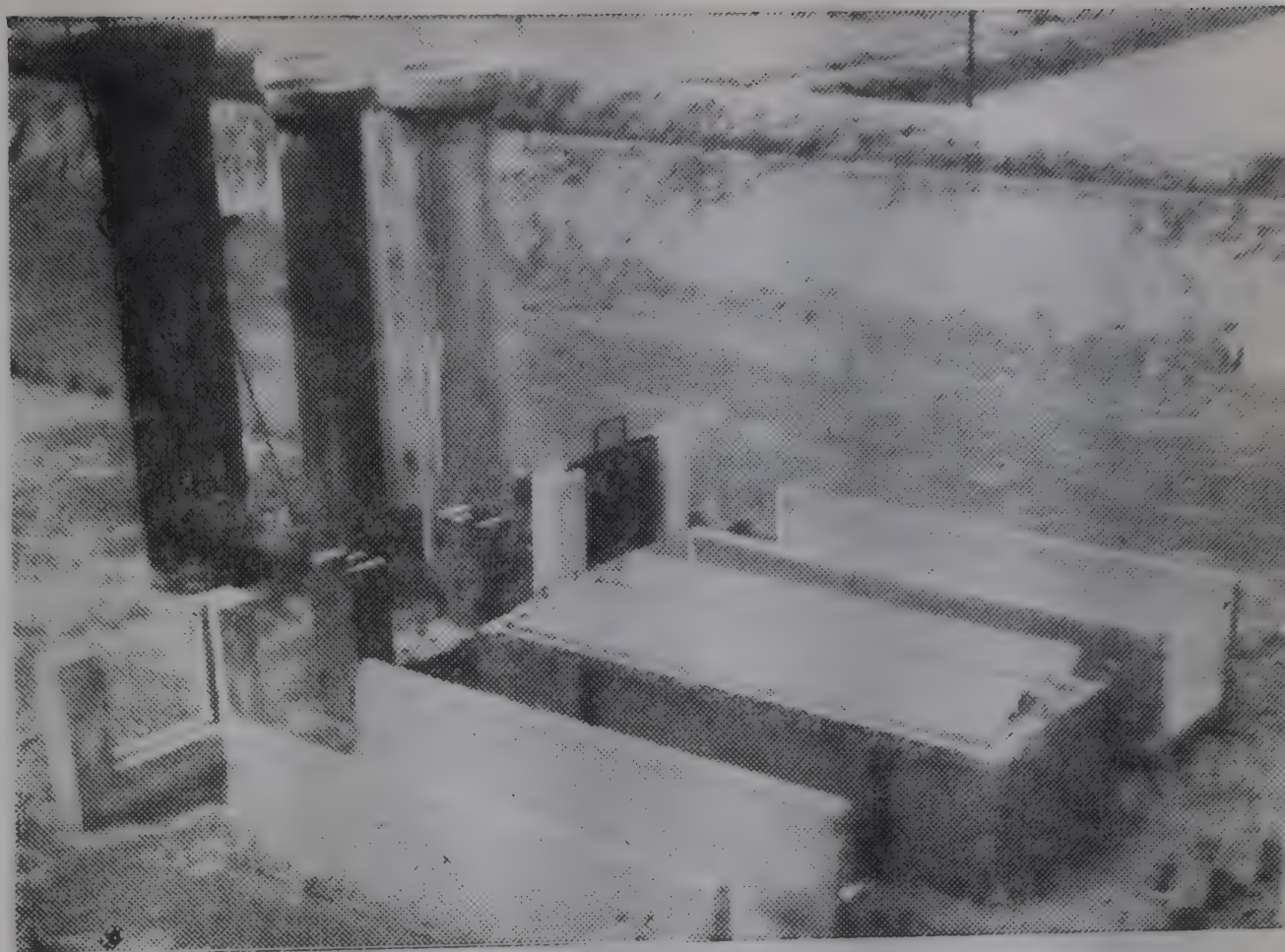


Fig. 4. Prefabricated concrete channels, check gates and pipes used in the conveyance and distribution of water on an average farm. The forms used for making the three structural units are also seen in the picture. All these could be made locally on the farm. In addition to constructing the channels, almost all the structures required for water distribution and control on small and medium size farms can be constructed with the three basic components.

age will be less in a rectangular section than in a trapezoidal one. The experience of lining work in Punjab and Haryana shows that the farmers prefer a rectangular channel to a trapezoidal

one. In general, it may be said that a rectangular cross-section is to be preferred in the case of water courses and field channels lined with brick masonry. However, for main canals, minors and distributaries, the section should preferably be trapezoidal, unless there are other over-riding site conditions which may require a rectangular section. Concrete-lined channels are almost always of a trapezoidal section, except precast channels which have a rectangular section internally.

The need for plastering the inside of the brick-lined channel is often debated. Obviously, the saving in water by plastering is negligible if the brick lining is done properly and pointing is done at the joints. However, the experience in the lining of water courses in Ferozepur and Faridkot districts of Punjab and Mohindergarh district of Haryana showed that good workmanship was often lacking and the linings were leaking until they were plastered.

Channel structures: The surface channel water distribution system requires various structures for conveyance and control of water. These include structures to control erosion in field channels (straight drop structures, pipe drops and chute spillways); water control and diversion structures to provide easy and effective control of irrigation water on the farm (check gates, diversions, turnouts, spiles and siphon



Fig. 3. A masonry drop structure with wooden check gate to control erosion in irrigation channel. Note the stilling basin on the downstream to dissipate the energy of the falling water. The check gate provides control of the water in the upstream section of the channel.

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es) and structures at channel cross-sections (flumes, culverts and inverted siphons). These structures require proper selection, careful design and construction.*

Cost analysis of surface irrigation distribution system: The cost of lining irrigation channels and constructing the required structures varies with the prevailing cost of materials and labour and other charges. The cost components include the expenditure on earth work, masonry materials, laying the lining, plastering, and on engineering and supervision. The cost is usually expressed on a unit length basis such as cost per metre length and in terms of cost per unit area of the surface area of the lined channel. In estimating the total cost, the proportionate expenditure on the structures is added to the cost of lining the channel.

Underground pipeline water distribution system: Underground pipelines offer many advantages over open channels in water conveyance and distribution. Since the pipelines are placed underground, cultivation can be done above the pipelines; no culverts or other structures are required. Open channels often take 2 to 4 per cent of the land area out of cultivation. Pipelines do not interfere with farming operations, and, when properly installed,

* For detailed description of the structures, reference is invited to *Handbook of Farm Irrigation Structures* available from the Water Technology Centre, Indian Agricultural Research Institute, New Delhi.

Fig. 6. A freshly laid line of underground pipeline in Rupar district, Punjab. Backfilling is done with the excavated earth after the line is checked for possible leakage.



have long life and low maintenance cost. They are essentially leak-proof and their placement below ground level prevents

damage. Since pipes operate under pressure, they can be laid uphill or downhill, thus permitting delivery of irrigation water to areas not accessible by open channels. They are also not clogged by vegetation and wind-blown materials. Water pumped from wells may be delivered directly into the pipeline system. With an underground pipeline system, wells need not be located at the high point of the farm, but may be at a location that provides the best water supply.

Underground pipeline irrigation distribution systems have a higher initial cost as compared to lined open channels. They may, however, be more economical in many field situations when the cost of land saved for cultivation and other advantages are considered.

Generally, underground pipelines are not very suitable under the canal irrigation system because of insufficient head and silt in water and, therefore, open channels are generally used to convey water. Pipelines are very suitable for pumping schemes as very little extra power is required to provide the necessary head required to distribute water through the pipeline

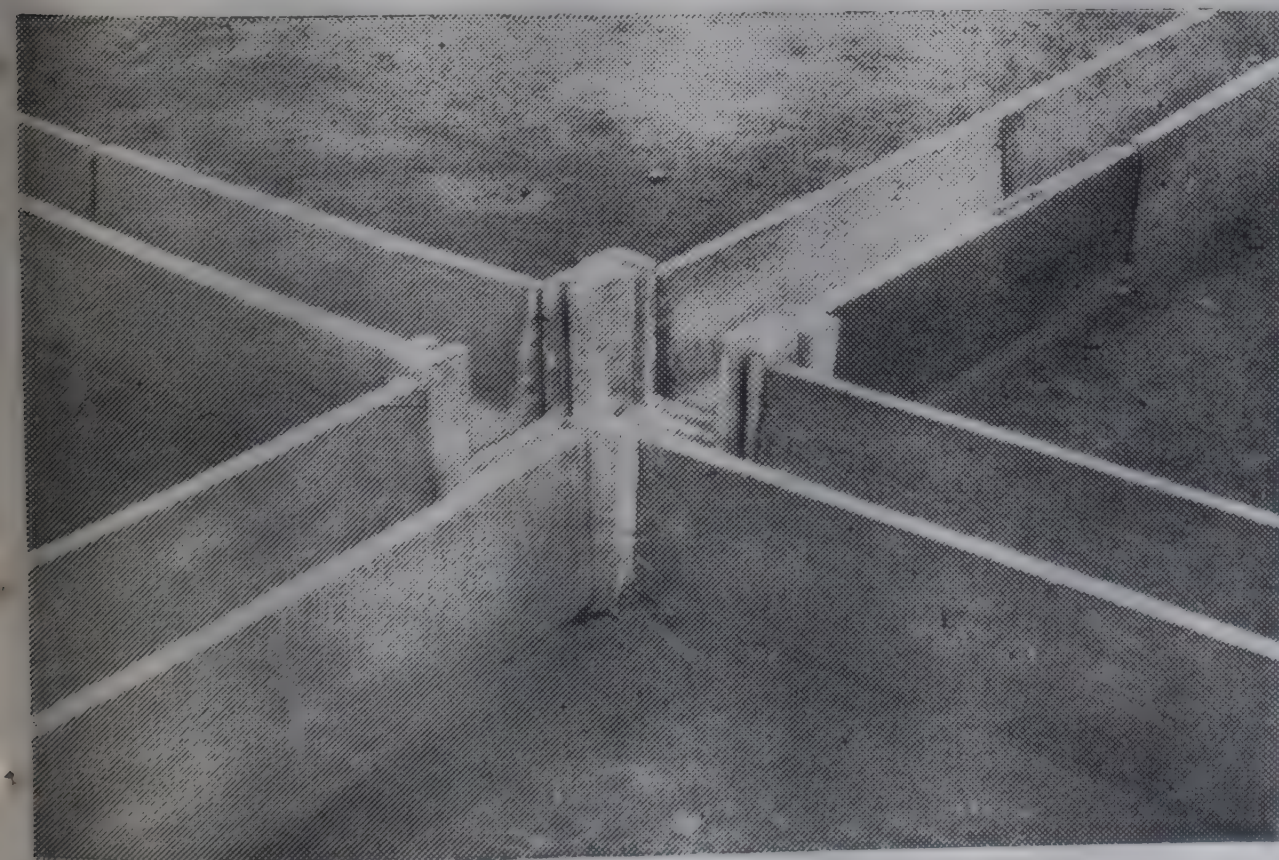


Fig. 5. A three-way channel diversion formed with prefabricated channel sections and check gates. Water may be diverted to any one of the three lines by closing the remaining two check gates.

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Underground pipelines can be constructed with factory-made reinforced concrete pipes, asbestos cement pipes, PVC pipes. In the case of small lines, when high pressures are not involved, the underground pipeline irrigation distribution system may be constructed with non-reinforced home-made pipes and accessories. Reinforced concrete (RCC) pipes are by far the most common. The majority of the RCC pipes used are manufactured according to Indian Standard, IS: 458. They are usually available in sizes 15 cm, 22.5 cm, 30 cm, 37.5 cm and 45 cm. The lengths vary from 1.8 to 2.5 metres.

Proper installation of the pipes is the key to trouble-free service of the underground pipeline irrigation system. To prevent damage of the pipeline from heavy loads and tillage implements, concrete pipes should be laid with their top surface at a depth of about 60 cm from the ground surface. The grade of the pipeline is kept uniform and is usually the same as the average land slope along the line the pipes are laid. To obtain uniform depth and grade, the elevations of the trench bottom are fixed with dumpy level. Each pipe should be laid on firm, undisturbed soil. The trench should be reasonably straight. The bottom of the trench should be smooth, with large stones, clods, or other irregularities removed. Pipes with bell ends are laid with their sockets (bell ends) facing upstream. Jute or hemp



Fig. 8. Outlet of an underground pipeline. The flag beside the valve helps to locate the riser valve from a distance.

ropes dipped in cement paste is wrapped round the plain end of each pipe. The pipe is placed well into the socket, and care is taken to see that the packing is not pressed through the pipe. After ramming the hemp tight with a steel tool, the remaining space in the socket is filled with mortar (1:2 mix) and finished with a bead on the outside.

The preparation of trench and foundation for laying RCC pipes with plain ends and collars is similar to that of the RCC bell end joints. In this case an adjacent pipe is laid with a collar slipped to its end. The pipes are laid with their ends placed about one cm apart. The gap is left for fixing a rope dipped in hot bitumen and placed in the recessed end of the pipe. Squeezing of individual pipes in the line is done when at least 4 to 5 pipes have been laid, usually with a heavy duty jack. After the squeezing operation, the collars are slipped over the joints. The gap between the collar and the pipe is then filled with a dry mixture of cement and sand in the ratio of 1:1. The collar is then lined with plaster and bevelled off. All mortar joints are cured by moist soil or wet gunny bags and by occasional sprinkling of water.

Structures for underground pipelines: Specialised structures are used with underground pipeline systems to control the water and protect the pipeline from damage. These include the



Fig. 7. Hole made in the underground pipeline for fitting the riser outlet pipe. Note the riser pipe placed beside the hole.

structures at the inlet, water control and diversion structures, air release vents and end plugs. Manholes are also provided under conditions of silty water.

Water may enter a pipeline by gravity from an open channel or it may be pumped from a well or other source. An inlet structure is required to develop the full flow capacity of the pipeline, to maintain water surface elevations sufficient to distribute water to the different points on the farm, to ensure that excessive pressures do not cause damage, and keep trash from entering the pipe. The inlet structure is constructed of RCC pipes placed vertically or of brick or stone masonry. A minimum size of 60 cm inside diameter for pipes and 75 cm for square tanks is used for the inlet.

Outlets are provided in the pipeline to provide controlled delivery of water to the fields at any desired location. The outlet consists of a water-tight valve installed on a concrete pipe. The pipe-valve structure is installed vertically over the pipeline over the hole made on it at the desired point of delivery.

Other essential structures consist of junction boxes at the junctions of

pipelines, air vents at the end of the pipeline and at about every 200 metres on the line or when there is sharp change in the bed slope of the line. The function of an end plug is to close a line and to absorb the pressure developed at the end of the line on account of water hammer. The plug is backed by a concrete block which provides sufficient strength to meet unexpected high pressures developed due to sudden opening or closing of valves.

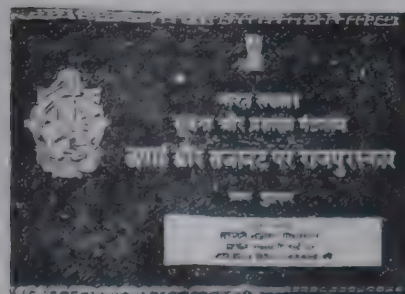
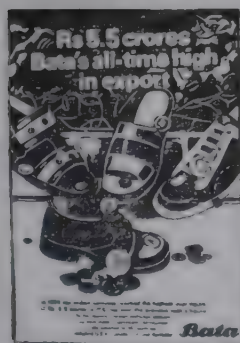
Hydrants and gated pipes: Hydrants are devices placed over riser valve outlets as a means of connecting portable gated pipes to the pipeline. The hydrants are portable so that they can be moved from one valve outlet to another to serve the portion of the field which is being irrigated at any particular time. Gated pipes are portable lines with uniformly spaced outlets used for releasing irrigation water to furrows, border strips or check basins. They are usually constructed of aluminium or lightweight steel tubing. Small finger tip operated rubber or metal slide gates are placed along the side of the pipe at uniform distances apart. When connected to buried pipelines through hydrants, they permit conveying the water in an enclosed system from the source to the head end of the

irrigation strip. Seepage losses are reduced to a minimum. They also provide a convenient means of regulating flow of water into the furrows or border strips.

Cost analysis of underground pipelines: The cost of laying pipelines varies considerably. It may vary with the type of pipe, labour charges, depth of laying and the type of joint used, of which may differ from place to place. The components to be included in the estimate are cost of earthwork including trenching, blinding and backfilling, cost of pipes and accessories, cost of installation of pipes, cost of structures used with underground pipelines and cost of engineering and supervision.

A properly designed water distribution system will make irrigation efficient and efficient. The type of conveyance system to be selected, namely surface channels or underground pipelines, will depend upon the source of irrigation water, whether a canal or a well, the topography of the field, economic status of the farmer and the cost of land. Several types of structures are used to divert, convey and control irrigation water. A well designed water conveyance system and irrigation structures are an essential part of efficient irrigated agriculture.

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Planning and implementation of Command Area Development

by Vinod Pande

COMMAND Area Development (CAD) programme has become the central programme of agricultural development since the closing years of the Fourth Plan. Its importance is based on the recognition that self-sufficiency in foodgrains can be achieved on an optimal utilisation of irrigated areas alone; if we get three tonnes of foodgrains per hectare in irrigated areas we can have an assured production of over 150 million tonnes. Our larger but extremely unreliable production system of rain-fed agriculture can be kept out of the picture completely. The basic assumption is that a very large increase in productivity can be made in irrigated agriculture. This can be obtained quicker than development of agriculture in rainfed or dry agriculture and it will certainly be a more reliable increase in productivity.

The guiding principle in preparing CAD plans is to achieve a relationship between cubic metres of water available and tonnes of crop produced in the command areas. The objective is always to maximise the agricultural production in tonnes as related to the cubic metres of water available. CAD programmes can be for canal command areas or tubewell commands. It is one of the peculiar facts of Indian agriculture that agricultural development of an area with wells/tubewells is more difficult to undertake than canal command areas even when irrigation is much more assured, of higher intensity and captive in the case of well owners. Canal command farmers are more responsive. We are here concerned with CAD in canal command areas alone.

We start by an assessment of the water available in the catchment, reservoir or under the ground. Moisture availability by rainfall or lift and flow

resources is adjudged. This is compared by the actual availability in the command areas. We at once come upon the first set of problems to be tackled.

Irrigation potential

The slow growth of irrigation potential into actual irrigation in the older project reports has been almost taken as an act of God or a fact of nature. The reasons fall into two broad areas. First, the irrigation infrastructure upto the farm level is not complete even when the irrigation system has been reported as completed, i.e. upto the outlet. Secondly, the offtake of water by the farmers is below the availability. Both these deficiencies can be rectified by investment and effort. It has been shown a number of times that investment to fully complete an irrigation system or reduce the gap between potential and actual irrigation quickly has a higher cost/benefit ratio than using the same investment for producing another similar incomplete irrigation system. Water courses can be made at the farmer's cost without soliciting his delayed understanding and consent. Farmers not being ready for irrigated agriculture is usually a problem of resources for these particular farmers: in a much smaller number of instances, a matter of technological backwardness.

Exorbitant loss of water in delivery system: When canals should be lined they are left unlined. Critical lengths susceptible to decay and leakages are disregarded. Water courses are left as unlined. Control structures are fewer than they should be.

These and myriad other reasons are the results of compromises made between the project report which provided for everything and the sanction which, in fact, was for perhaps half the amount and the annual releases to the irrigation project which were squeezed even more. Problematic escalation of

costs is often due to deliberate underestimation to get the project sanctioned.

Law of jungle below the outlet: An irrigation system may report one lakh ha of net area irrigated. This may well enough mean that some of this area received 400 per cent intensity and most of the tail enders got 50 per cent of their due. Some outlets are four times the size of the outlets allowed and some will not be available on the ground.

Every irrigation department has a system of publishing seasonal roster of irrigation. Not many farmers will make a formal complaint also. But the fact of utter chaos is there for everyone to go around and confirm for himself. The management of an irrigation system is too important for us to be satisfied by the certification from the department of irrigation alone that all is well. All irrigation systems must have an integrated superior management. Management of one lakh ha of irrigation is management of a production resource of product value of Rs 30 crores. Would a unit of production potential of Rs 30 crores in industry be placed in charge of a manager with emoluments of Rs 1,000 per month?

With adequate water delivery having been arranged at the outlet we encounter the second set of problems.

The best farmers' yields are much above the average yields: This represents the first phase extension task of getting the maximum of the known level of technology. The second extension task is improvement of the best farmers' yields. This needs research input; giving a new variety, changing the fertiliser or pesticides levels substantially etc.

The farmers' incomes are non-optimal for their production: This identifies the infrastructure problems—lack of roads, markets, warehousing, cotton gins, rice mills, quick transport. One must

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forget that isolation reduces demand which is the chief incentive for increasing productivity. Most of the irrigation systems can profitably put 1 per cent of the area under fruits, vegetables and perennials; this is not the case because of lack of marketing infrastructure. Most of the farmers in the canal command areas can keep quality milk animals and breed meat and poultry. The management of the unirrigated holdings in the command area, pasture management, farm forestry is below what it can be. Subsidiary income sources are undeveloped.

Drainage problems

Quite a few of the irrigation systems do not provide adequately for drainage. This has led to the investment in irrigation having become counter-productive: water-logging conditions, increase in water table, soil salinity, even permanent damage to arable land. If soils are heavy and with low permeability or if the water table of the area is high then intensive irrigation needs the circumspect measures of drainage to be provided simultaneously with the irrigation system. Provision of drainage, as a completing investment, must have priority over new investments.

Farm water arrangement

The usual system of irrigation is by flooding of the fields; it is rarely that the farmers have farm channels. The water required to provide sufficient irrigation uniformly to all portions of the field in a watering is a function of the land levelling practised. Here the standards accepted by the farmer are woefully inadequate compared to scientifically optimal standards. He does not easily concede that fine levelling should be done to avoid over and under-irrigation.

It has been said that while India is short of irrigation, we are also the biggest wasters of water in practising irrigation. The consciousness to improve the water management practices in the field can be brought about by two other reforms which are necessary—charging for irrigation on volumetric basis and charging at economic rates which recover the proper maintenance expenditure at least of the canal system. Another aspect of water management is proper Waribandi system with a regularity which matches crop requirements.

The above analysis carried out for an irrigation command area will give an inventory of the following type:

A. Improvement of existing irrigation system:

1. Lining or improvement of canals
2. Drainage works
3. Control structures
4. Rationalisation of outlets
5. Proper maintenance budget.

B. Macro development of command area:

6. Roads
7. Market yards
8. Promotion of processing industries
9. Forestry, pastures.

C. Farm development:

10. Lining of water courses
11. Land levelling farm draining works
12. Intensive extension system
13. Ground water development for increasing irrigation intensity.

D. Institutions:

14. Integrated management of canal system & agriculture in CAs.
15. Special credit institutions.

A command area development programme as above prepared for a particular irrigation project displays the following common features:—

Sizable government investment: It will be seen that the entire investment required for improvement of existing irrigation and macro development of command area requires budgetary funds in the State Governments' plans. Irrigation sector of the State Governments is hard pressed. For finding adequate annual provisions for works in progress and the command area development programme is an additional item requiring sizable funds. It is, perhaps, necessary at the Central level to divide the total Central assistance under the irrigation sector as between canal construction and command area development. This will force the State Governments to provide for the command area development programme's requirements for infrastructure development. As a long-term policy the new irrigation projects must have a minimum amount of command area development built into them. Sanctioning irrigation projects piecemeal has proved to be a costly alternative.

Apart from the improvement of the irrigation system, roads and forestry and pasture programmes have to be provided for. Canalside plantations have both a protective and an economic role. While the road budget in most of the State Governments is considerable, finding

funds for the command area becomes a problem as plan allocations in the State Government try to spread the benefits as widely as possible.

Roads which can be made everywhere are, therefore, given in the least measure to developed areas like the command areas. Some of the State Governments have been able to finance road investments from the market fees of the market yards. The market yards within a command area are bound to become substantial institutions. Modern market yards can also be built through bank loans as is done in Bihar, Haryana, Rajasthan, West Bengal and some other States. If the market fee is more than Re 1 per Rs 100 of transaction, the investment loan for a modern market yard can be repaid in 5-7 years. In due course, the investment for feeder roads can also be made by the market yard. It may, therefore, be necessary to give priority to a programme of construction of market yards on bank finance and to complete the major road network through State investment.

Area development

The existing or new market towns which are developed as a result of prosperity of irrigation would be the rational centres for setting up rice mills, dal mills, cotton ginning units, solvent extraction plants, etc. In the larger command areas sugar mills and spinning units have also to be planned for. If the intensity of irrigation is sufficient for a considerable area under fruits and vegetables, units for canning and food products would also be required. All these investments can readily be found in the private sector. The State Government has only to identify and promote these industries. It is worthwhile to hire consultants and have an agro-industries plan prepared for the command area. This, with strengthening of the Industries Department, can look after the promotion of industries so that the possibility of lower demand and non-optimal prices for the farm sector which result due to the lack of primary processing infrastructure is completely avoided.

While the primary income of the command area farmers is better, it is noticed that the subsidiary incomes of even the big farmers in the command area is poor. Very few command areas are covered by Amul type dairy projects or are considerable producers of meat and poultry. On the other hand, the feed resources of these areas are the best and development of a marketing infrastructure in the command areas can considerably benefit at least

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smaller farmers in the command

farm development

The cost of any programme of land development involving improvement of water courses, some land levelling and drainage work is likely to be not less than Rs 1,500 per ha. This is, however, an economic proposition and the competent authority can negotiate agreements regarding on-farm loans with banks for such purposes. While this is true it is also true that to mobilise more than Rs 1,000 per ha programme for a lakh hectares and to ensure carry-out of the development work is a major administrative task.

The first principle here is to select only those tasks of land development which the farmer is agreeable. If agricultural technical experts tell you that something requires to be done for which there is no farmer response, then the area is not ripe for undertaking the particular development on the basis of on-farm loans. Land development programme, even if it is carried out 100 per cent by Government fund is technically a difficult programme to implement. With the additional problem of mobilising loan resources for this programme, it becomes almost impossible to tackle a particular development where the farmer is not even willing to have it carried out. If the programme drawn out by the technical experts is of this complexion, then the right thing to do is to sanction a research-cum-extension project which carries out model improvements in the command area at government cost and through this effort gradually builds up an acceptance and a desire for such land development. In such cases, it would be folly to jump into implementation of the technical recommendations.

To give an instance, in the Rajasthan Canal, the farmers were quite enthusiastic for lining of water courses and could see that this would release additional water for them. On the other hand there were some reservations about fine land levelling and very serious reservations about farm channels. The bulk of the development programme, in this instance, therefore, could only be of lining of water courses.

While the land development must be carried out through on-farm loans, physically it is necessary to identify a big programme and to execute it through a central agency. The programme implementation would be inefficient and costly if it is a sum total of thousands of small job works which cannot be tackled as one job starting on

definite areas and completing the total land development in that particular area. This requirement means that at some stage or the other, either the choices of farmers have to be 100 per cent or the minority of them have to submit to a law for the land development. In case owners of 90 per cent of area in a chak have agreed to line the water course, it should not have to await persuading the remaining 10 per cent to agree to the project. There are provisions in the Irrigation Acts, and Soil Conservation Acts of the State Government which promote this approach. However, it is still a new thing to be done. It is, therefore, advisable to streamline the provisions in such Acts fully before a large scale programme of land development which uses these provisions is taken up for implementation.

The contractor who is to carry out the land development, should not be saddled with the responsibility of extension, for preparation of loan application or arranging for funds bit by bit. A separate agency must mobilise the loan resources and keep the contractor, who may be the Irrigation Department or the Soil Conservation Department, or Agro-Industries Corporation, suitably in funds. Their task is difficult enough to be not saddled with the problems of loan applications, bank releases or getting permission of farmers to enter the fields. A separate agency must get the loan applications filled, issue notices under the relevant Act, get the sanction of the bank for sub-project, arrange the availability of funds and confirm the notice. The area and the funds then can be taken over by the engineering agency to complete the work according to schedule.

It is easy to recognise that obtaining bank funds for all the farmers involved over a large command area development programme would be problematic. Some farmers, due to a variety of reasons, are just not eligible for the loan required. It has, therefore, to be recognised that the availability of bank loans for a land development programme will meet 60-70 per cent of the total requirement. The loan on behalf of the non-eligibles will have to be provided by Taccavi from the Government.

Secondly, in some of the command areas where revenue records are in a bad shape, even with the best of will, the banks may find it a problem to sanction particular applications. A revenue record correction done in advance is of some help. Of even greater help is to make some drastic amendments in

the revenue laws as may be required to get over the problem of record and guarantees required by commercial banks.

In Rajasthan we set up a Rajasthan State Land Development Corporation which undertook the total work of raising bank loans for eligible farmers and of channelising the Government taccavi for the non-eligible farmers. The statute which set up the Corporation gave it authority for recovery also. Another advantage of this Corporation was that it could make advances out of its own funds to the contractor of land development even when the loans from the area which was being tackled, had not all been received. This facility of keeping the contractor in requisite funds is very necessary as a breakdown in the construction work is costly to the farmers.

Irrigation rate

Some State Governments have considered recovering farm investment as betterment levy or by special rates of irrigation. The receipts of either of these spread over years and the method is feasible for only those States which can immediately find all the money that is required for land development. In this context a *sine qua non* of venturing into a land development programme should be adequacy of irrigation rates from the very beginning.

There is no reason why the irrigation rates of a command area, which is to have command area development, involving substantial government investment leading to higher incomes of farmers, should be anything less than economic. Amendment of the irrigation rates so that they meet the full requirements of proper maintenance of the irrigation system should be insisted upon as a necessary condition for taking on command area development.

It would be foolish to undertake investment in improvement of the canal system on one hand without ensuring that the investment made is not eroded due to lack of proper maintenance. In a large number of cases costly improvements have to be done now because proper maintenance was not done in the past. It would be surprising for some to know that, by and large, the irrigation cost to a farmer in a command area today in India is lower than the cost of lift irrigation to the farmer owning a private well. The irrigation rates in very few systems recover the full maintenance requirement.

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age is neglected until it becomes a serious problem. The farm drainage systems must be maintained by the farmer himself. The main drainage works require a lot of maintenance and most is labour intensive work. We must insist upon the command area farmers paying a minimum drainage fee from the very beginning which would increase to the proper drainage rate for that portion of the Command Area.

One of the things to be experimented with is the funding of irrigation and drainage rates in a fund with the command area administration itself so that a direct relationship between maintenance requirements and its financing can be established. It is true that in the initial years the maintenance requirement is lower and increases gradually. Some experimentation in this regard may be useful.

Productivity improvement

Ground water development of certain canal command areas has a direct benefit of increasing irrigation intensity and in some cases it helps to get the water table down. It is not every farmer who looks up to having intensities of more than 150 per cent. The best of the farmers, however, can and do exploit cropping intensities of 300 per cent or even 400 per cent. In case of costly cash crops a captive irrigation source which will protect the crop investment from the vagaries of the weather and faulty rostering is essential.

I have mentioned earlier the two stages of agricultural development through extension. The first thing to realise is that extension is very cheap compared to its benefit. We planned some of the most intensive extension programmes in Rajasthan and Chambal Command Areas and the cost of the total field staff remained below Re 1 per hectare per year. Nobody minds paying for an effective extension system. The real thing is to establish success in the very beginning.

The extension system to be given to a CAD area has to be organised on the following principles:

- (i) The availability of extension staff in the area must be intensive, i.e. at least on the norms of the IADP Projects.
- (ii) The village level workers (VLWs) and extension officers should not be left on their own and must be intensively trained and supervised round the year. This means that every village level worker must be given

instructions for his work for the week or fortnight by calling him to the local training centre for a day. He must report progress and take instructions for the ensuing week. Village level workers left on their own are almost useless.

- (iii) The extension programme must cover limited number of farmers where results can be checked or demonstrated clearly. It should consist of one or two simple developments only in a season. For instance, in the first season, the VLWs should merely have the task of ensuring that population of plants in the fields of the selected farmers are not below a minimum number per unit area. VLW should be prepared to increase the number of plants himself if necessary. In another season the extension programme may be about timely watering only. Similarly, in a particular season one or at the maximum two crops should be tackled in the selected villages for selected farmers only.
- (iv) The extension organisation within a command area must be supported by a research unit located within the area. The training of the extension workers, formulation of the seasonal programme, problem solving of the field problems must be done by people who have research background of the crops and of the area.

If the extension programme does not register at least a 15 per cent increase in production for the covered farmers in the first year itself, it should be judged a failure. If it succeeds in the first year, it will grow as a popular movement.

Command area authority—

We have earlier brought out that the water management of a canal system is too important to be entrusted to the engineers alone. Engineers may well become command area administrators but they would have to tackle their task by defining it quite differently than what is considered by them as their proper task today. Usually, the responsibility of the maintenance division of the Irrigation Department finishes off at the minor outlet. If water is available according to the declared roster at the outlets, the task of the Irrigation Department is complete. There is a rough and

perfunctory consultation with the Agricultural Department about the crop requirements but this in most cases is entirely a formality done perhaps once in the beginning, for all times to come. In any case the extension service of the area has almost no say in obtaining any modification of it.

CAD programme envisages common control over the distribution of water through the canals and its use in the fields. The command area administrator has to be accountable for a return which relates agricultural produce with cubic metres of water. The basic requirement, therefore, is to have an organisation managing both the irrigation and agriculture of the command area which has also an effective say in all other development departments which contribute to agricultural productivity of the region.

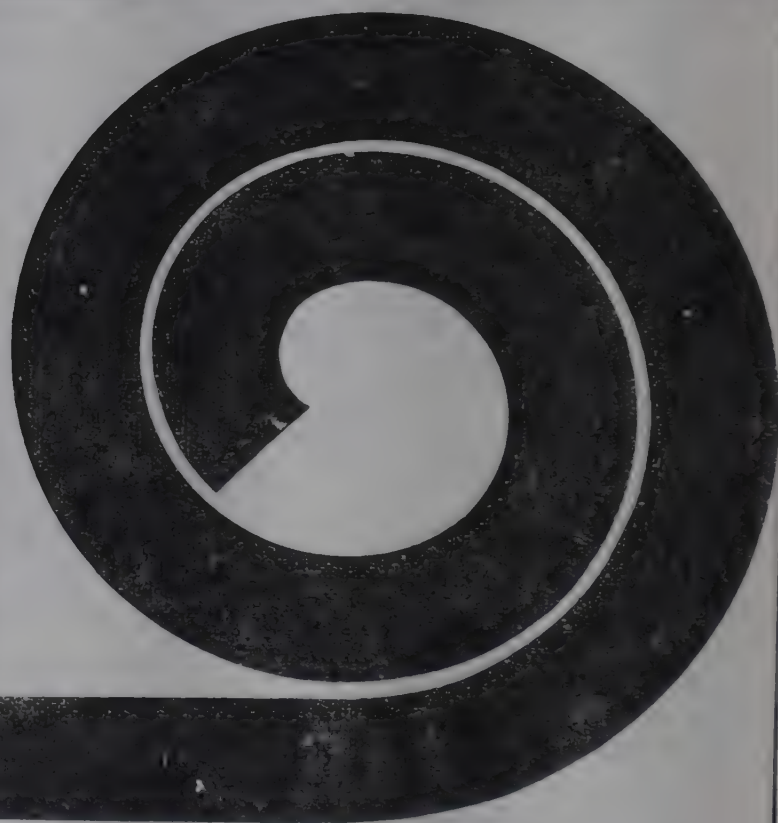
It is obvious that the responsibility of executing the infra-structure development works as well as the land development programme will be the direct responsibility of this integrated authority. This in turn leads to the diverse requirements. The authority should have powers of land revenue administration, effective control over the organisation which arranges for the financing of the on-farm portion of development, the agency which undertakes land development, the departments which execute the various infra-structure development programmes as well as those which undertake development of market yards and agro-industries. The integrated authority to be effective in such a wide span would have to be of corresponding powers and administrative authority.

Direct vs. indirect control

It is perhaps necessary in the beginning to distinguish between areas where direct and complete control is required and areas where powers of effective interference should be sufficient. In Rajasthan, we found that the Command Area Authority should directly control the command level activities of the Irrigation Department, Agriculture Extension Department, Revenue Department, the Agency for Land Development and the agency making arrangements for the financing of the on-farm programme. On the other hand, co-ordinating powers were sufficient for the programmes of other departments like roads, forests, animal husbandry, ground water, power, etc. Giving the direct responsibility of these to the Area Development Authority could dilute the attention which it must pay to agriculture and irrigation.



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The basic difference between direct control and co-ordinating control is that in the former officers of command level and in the latter category are supervised and responsible to the head of the departments at the State headquarters, usually. On the other hand, for officers of departments coming under direct control, unit of administration was the command area, they were of the joint director/superintending engineer or the level of the department rank and were directly controlled by the Area Development Commissioner who had been given powers of the head of the department or the Departmental Secretary. As far as the items of direct control were concerned, the budget of the programmes was transferred to the area development authorities' budget in the State Government's Plan and annual budgets. This also incidentally assured that plan and budgetary allocations for the command area are left undisturbed from the pressures which go towards constant re-allocation of funds within a State Government.

Form of authority

One question debated in detail in the Planning Commission and the State Governments was whether it would be desirable to set up statutory corporations or public sector bodies under the Company Law for the command area authority. It was realised that the company form could at best provide flexibility of operation for execution phase of the command area development. On the other hand, command area development did not end with the completion of the roads or on-farm work but the process really began with the completion of these civil works.

The objective of water management for optimum productivity was a continuing responsibility. The statutory form had certain advantages. Certain legal arrangements could be had for the command area alone. The statutory corporation could allow for total management of the development of the area and be related to the revenue in all forms accruing to Government out of the productive activity or the land assets within the area. It will be seen that the cost-benefit analysis of command area programmes provides for investment from government account while the benefits are entirely social or higher farm incomes. We do believe that these higher farm incomes over a number of years will bring back the investment to the State Government in more than one way.

However, the model still remains an open one and justified by social bene-

fits alone. In practice, it was found that enactment of an elaborate statutory authority or corporation for command areas would delay their setting up very considerably. It was also found that authority of various officers who would be part of the command area authority derived from specific State laws of the Government. This would not vest in them unless they held particular State Government offices and were merely functionaries of a corporation. This means that provisions would have to be made for giving corporation officers identical powers to what they already had as government officers. Some problems relating to the command area administration in the corporation form with the total administration of the State Government in its various services were also noticed. It was, therefore, decided to create command area authorities by regionalisation of departmental working within the command area and by creating a new regional department.

In many State Governments, the district collector has been given powers under the statutes governing the departments for supervising departmental activities. There are States where the district collector has the authority of director of agriculture, registrar of co-operative societies, etc., as far as the district is concerned. On a similar pattern, the Area Development Commissioner was given powers of Secretary or the head of the departments of irrigation, agriculture, revenue, co-operatives, etc. Where the departmental officer at the command level was himself of the rank of a head of the department, Area Development Commissioner was made a Secretary and where the command level technical officer was of the level of a joint head of the department, the ADC was given the powers of the head of the department.

It was found of great importance to bring the location of the command level officers to the same place and as far as possible, to house them in the same building.

The relationship of Area Development Commissioner and the heads of departments in the State capitals was of two types. In case of the direct control departments, the responsibility of issuing sanctions and implementing the annual plan were finally with the Area Development Commissioner. No transfer from the command area or to the command area could be made by the head of the department and transfers of departmental officers within the command area could be made by the ADC himself. The supporting actions of the department for the command area pro-

gramme were negotiated and arranged between the Area Development Commissioner and the head of the department.

On the other hand, in the case of co-ordinative control departments, the responsibility of the annual programme continued with the heads of the departments. The Area Development Commissioner could review and control and monitor the progress of the programme in the command area. Posting and transfer of staff, timely issuing of sanctions etc., were done by the head of the department but with approval and always subject to review of the Area Development Commissioner.

The implementation of the command area programme was supervised by a committee presided over by the Chief Minister at the State headquarters. A board was provided at the command level which included non-official members.

Implementation—chief problems

As far as implementation of the civil works programme is concerned, most of the departments can be trusted to complete the jobs in time, if the allocations are proper and sanctions are issued in time. The real problem related to three areas: (1) Land Development; (2) extension; and (3) water management.

Land development

As stated earlier, land development in implementation has two problems: the first relates to raising own farm finances adequately for a programme taken up on a large scale. The second is to clear up all the problems of title, farmer consent, revenue laws, absence of papers etc. It is clear that neither the farmers by themselves nor agents of commercial or co-operative banks can undertake the massive task of preparation of loan applications.

Elsewhere large loaning programme for construction of wells have been successfully executed by the collectors by forming teams of revenue officials, bank officials and holding camps where loan applications for an entire area are completed. Basically, the patwaris have most of the records which are used in a loan application. In Rajasthan, we thought of a system of giving patwaris honorarium for preparation of loan applications within the stipulated time. In certain areas, it was necessary to sanction a land correction drive to make anything possible. In some cases, staff was available for preparation of loan applications and in certain others, the revenue staff of the district had to be augmented. The patwaris were assisted

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representatives of the commercial co-operative banks in preparing applications.

An agreement was sought from the banks for examining the application within a specified period of time. Cost estimates were simplified and provided for the chak by the survey wing of the contractor. We provided for officers from the commercial banks involved in the programme to be appointed as OSD (Joint Director) in the command area authority.

Again the bank forms were simplified and to the largest extent standardised among the participating banks. Seminars were held by the bank officials to explain the important and important requirements in preparing a bank application. It was difficult for some banks to agree to all our requirements arising out of the desire to streamline mobilisation of funds. The banks also agreed to a system of providing bank advances to tide over problems in financing the agency implementing the large scale land development programme in anticipation of the loan applications under preparation being completed.

ADC was expected to do PERT scheduling of a number of activities such as (1) putting an area under notice for compulsory land development and confining it; (2) survey and completion of estimates by the survey wing of LD contractor; (3) land record correction if necessary; (4) preparation of loan applications on the basis of (2); (5) sanction of funds and releases by banks; (6) advance of funds to executing agency; and (7) entry and completion of land development in farmer fields to avert high compensation.

These deliberations on the best way to provide finances in a satisfactory manner for a land development programme taken up on the large scale evolved an idea of a land development corporation. The land development corporation is not a bank and is also not the executing agency of the land development programme. It is the organisation which arranges the preparation of the loan applications, which sanctions the taccavi to the ineligible farmers and from both these sources or from advances taken from the supporting banks ensures adequate finances being made available to the contractor doing the civil works. In case of the bank loans, the loans are made directly by the banks to the farmers and the money is paid to the Corporation on behalf of farmers for use on the development work. The original loaning of the Corporation consists only of the taccavi loans. It also arranges inspec-

tion and gives the completion certificates.

Our concept of land development corporation it will be seen, is very different than that of corporations set up in other States where bulk loans either are taken from the banks or independently raised and the corporation in turn acts as a banker for a development project by giving loans to individuals within the areas. We felt that where a person was eligible for a bank loan, he may as well take the loan from the bank itself. The recovery responsibility in such a case was unnecessary to be taken up by the corporation. The prime function of the corporation is to ensure that all the loans necessary for the development are sanctioned. It should, therefore, be concerned only with those loans which cannot be sanctioned by the banks and to see that the own loaning of the Corporation was kept within limits. It was decided that land development would be taken up within the areas where the own loaning would not be more than 25 per cent.

Extension

The real secret of success of an extension programme is firstly the formulation of the detailed programme and, secondly, the intensiveness of supervision in the organisation. The

choice of Director of Extension has to be on the basis of executive ability and that alone. The crucial extension programme must be formulated by holding seminars in the command area with the best talent which is available in the State Government or the Central Government or the ICAR. Any money spent on this should not be grudged. The centre for formulation of the content of the extension programme should be the research farm within the command area. If there is no research station in the command area, it is the first thing to be sanctioned. The World Bank expert working with us in Rajasthan was of the view that the village level work should be supported by voluntary workers selected from the best farmers or their sons in the village itself. Their payment chiefly was prestige of leadership and the usual cost of demonstrations. In some cases a small honorarium may be necessary.

The extension staff for too long has been multipurpose. This means that the village level worker can explain his shortfalls in agriculture by pointing out that he was busy in small-pox inoculations. As far as the command areas are concerned, the village level workers had to be transferred back to the agriculture department of the State and were responsible for extension task and



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hat alone. The panchayat samitis were given compensatory staff in the form of panchayat assistants to make up for the withdrawal where necessary.

The village level workers were, therefore, exclusively for extension task and totally accountable to their supervisory officers. An initial screening was done and incompetent persons were weeded out of the area. Because this extension programme envisages weekly refresher courses and reporting on progress at the training centres, the VLW's were provided some mobility. In the first season, very simple programmes like proper seed or plant population or timely sowing or uniform irrigation practices were attempted. The report that I have received of the success of the extension programme is sufficient confirmation of the planning methods.

Water management

Management is the heart of the change that is sought to be brought about in the command area development programme. The clear issue is complicated because of the stress it involves in changing the existing managers of the irrigation system or at least effectively forcing them to re-define for themselves their job objectives.

It would be a pity if the move for effective attention to water management is opposed by the hierarchies of the State irrigation department because it affects the present authority. They should rather look at the command area development concept as enlarging their functions which in the long run will also increase their effective authority. It is one thing to construct a dam and to build canals. It is quite another thing to use them. It is a third thing for the irrigated agriculture of that area to be what it should be.

Indians are recognised the world over as the greatest canal builders after China. On the other hand, the returns from irrigated agriculture in India are the poorest. The dramatic increase in the production of cereals due to introduction of hybrid seeds responsive to fertilisers is nothing compared to what can be achieved by the optimal utilisation of our irrigation systems. Water as an input contributes to agricultural productivity much more than fertilisers, seeds and pesticides.

In the Rajasthan programmes, we had suggested that a senior IAS officer should be the Area Development Commissioner. This is not a prescription for all time. And it is recognised that chief engineers of irrigation are season-

ed managers. The production programme made by the extension officer should be the given objective for the maintenance division of the irrigation department in the command area. The Area Development Commissioner should be able to intervene in waterings, question the lay of waterings, initiate examination of the size of outlets, call for explanation of water not reaching the fields, the tail of the water courses etc. The powers have to be clearly and explicitly given to the Area Development Commissioner. On the other hand, a successful command area development programme, there should be few occasions where they are used by the Area Development Commissioner.

The primacy of agricultural requirements and that these should govern the irrigation system must be recognised in theory, law and practice. The present situation where water is available as an act of God by the irrigation system and the farmer is free to use it to the best he can has to change. It should be possible for a command area system to use some agricultural engineers as it is possible for the irrigation engineers to be the executing agency for land development programmes in the fields of the farmers.

An area development commission must have a monitoring and planning unit directly under his control. Independent of all the reports which the director of extension or the chief engineer provides selected chaks in each of the minor systems must be researched in detail at the end of the season for water availability, water adequacy and agricultural productivity. However late this exercise be completed, it should again be taken up with the irrigation department and the director of extension for the due explanations.

CAD, to sum up, is a qualitative upgradation of the management of irrigation and agriculture in a Command Area. I have outlined the role of government effort but this is a part of the total effort and the complementary effort must be forthcoming from the farmers of the area. Our project report for Rajasthan Canal, for instance, envisages increase of farmer incomes four fold in the project period. Government can but improve the rules of the game which has in the end to be played by the farmers.

All agricultural development programmes are difficult and such a joy for the same reason. They involve so many human beings; not just their capital but a few hours of their effort; the whole life of so many human beings in all its profundity.

"Our duty to others means helping others, doing good to the world.... Yet we must do good; the desire to do good is the highest motive power we have, if we know all the time that it is a privilege to help others."

— Swami Vivekanand

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Role of forests in conservation of water

By Zafar Futehally

ONE of the tragedies of India is that the role of forests is not properly appreciated. One keeps hearing that agriculture contributes 50 per cent to India's Gross National Product, while forests which occupy almost half the area of cultivated land yield only 3 per cent of our GNP. The impression created in the mind of the common man is that forests should make way for more productive enterprises. No wonder, then, that between 1951 and 1973 over 5,000 sq km of forests were cut down. This is in keeping with the world trend where in the five-year period before 1969, 25 million hectares of forests were felled and only 2.66 million were replanted.

We might also remember that a natural forest consists of trees in close proximity, with their crowns almost touching one another. This close growth is essential if the forest is to maintain its true character and perform its duties. In a technical meeting of the International Union of the Conservation of Nature and Natural Resources, held in Delhi in November 1969, Prof. K. P. Merimanin of the Armenian SSA, USSR, made a significant point when he said that experience from the Soviet Union confirmed that "if the forest cover is thinned by 40 to 50 per cent its

soil and water protectability may well be lost. Our observation showed that in heavy rain water can pass through such thinned forests at the same speed as through unforested areas, specially when the green cover of pastures above the forest has been destroyed by overgrazing by cattle and by cattle tracks."

Canopy of trees

The above facts assume great significance when we realise that in India most of our protective forests are badly degraded and, consequently, do not perform their ecological function of holding the soil and conserving groundwater.

A special climatic feature of India is that it has a short wet season of four months between June and September, and a long dry season from October till May. If the rainfall had been better distributed throughout the year, as is the case in many other parts of the world, it would not have been essential to maintain our forests and our vegetation cover in top condition. But placed as we are and dependent as we are on rain water for agriculture, our biggest industry, our principal concern should be to retain our natural flora in good order for the conservation of water.

As is well known when rain falls on a canopy of trees the force of the rain

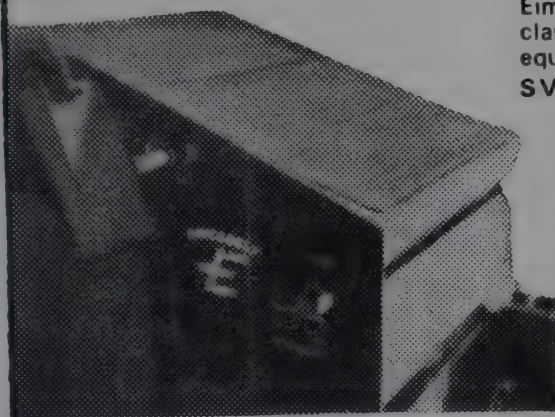
drops is broken and the water falls gently to the ground and percolates through the sub-soil through the humus below the trees. If the rain falls on bare ground it carries away the top soil with it, and the water rushes down uselessly to the sea. In the process, serious floods occur in the plains.

Unfortunately, no quantitative experiments have been made in India establishing the connection between adequate forest cover and conservation of groundwater. All that we know is that in places like Belgaum, the water table has gone down over the years because of the large-scale denudation of forests in the Ghat areas. Some studies have been done on the effects of grass cover, however, and the findings have been revealing.

In the Department of Botany in Banaras Hindu University, R. S. Ambasht studied the soil conservation and water holding capacities of several species of grass. "Two plots each 15 metres long and sloping at an angle of 30 degrees were prepared of alluvial soils. These were divided into smaller plots of 3 ft in length for planting individual species separately. One of the plots was kept bare as a control. At the base of the slopes cement channels were prepared to receive the run off of each sub-plot into separate compartments." It was found that *Cynodon Dactylon*

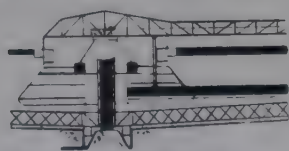
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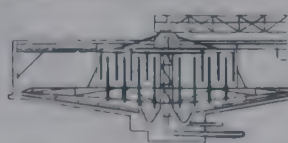
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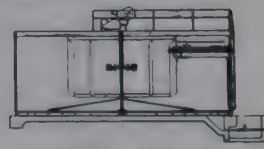
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served between 89 and 97.5 per cent of the water flow. Other kinds of grasses and shrubs are much less effective. Therefore, as recommended by the author, areas susceptible to erosion along river banks are planted with *Podon Dactylon*, *Saccharum*, *Munja*, *Perus Rotundus* and other grasses. River banks would not collapse through erosion as often happens, and much soil and water would be saved. Considering that one inch of soil takes years to build, the replanting of our eroded lands must be undertaken on an emergency basis.

Quality of vegetation

It must be recognised in fairness to ourselves that it is only very recently that even the so-called advanced countries have recognised the importance of ensuring good vegetation cover on the land. In the United States, because of their calamitous experience of erosion followed by dust bowls and droughts in the thirties, they have now developed a highly sophisticated technology about the management of land. E. A. Colman in his book, *Vegetation and Watershed Management*, sponsored by the Conservation Foundation, has brought much of this knowledge together. The quantity of water yielded by any area is influenced by three factors: the quantity of precipitation, the seasonal distribution and the quantity of solar energy received by the land. As has been confirmed by the Meteorological Association of the United States, seed clouding and other techniques are not likely to change the pattern of precipitation in the near future. The quantity of solar energy is also a factor which human beings cannot control. The only practical alternative is to manage the quality of vegetation on the land. By changing the pattern of vegetation it is possible to increase or reduce evapo-transpiration, and to similarly affect the run-off from the land. In waterlogged areas, eucalyptus trees have played an important part in improving the land. In dry areas where it is necessary to conserve groundwater to the maximum, it is obviously advisable to have plant cover which results in the minimum of evapo-transpiration.

For example, on deep soil, the protective cover of shallow rooted plants would be better than the existing cover of deep-rooted plants, and this would result in reduction of transpiration, and a corresponding increase in usable water yield. A trial carried out in the Wasatch mountains of Utah showed that

when deep-rooted aspen trees were removed from an area leaving only shallow rooted herbaceous plants, the annual loss of water due to evapo-transpiration was greatly reduced.

Modern technology

It is not as if in India ecological data were totally absent. In 1966, the Planning Commission carried out a survey of 13 of the major river valley projects and came to the conclusion that afforestation of the catchment areas was essential to prevent siltation of the dams and to ensure adequate supply of water during the dry months of the year. The paragraph from their report relating to the amount of precipitation of water yield of the Upper Damodar catchment is worth reproducing: "Total water resource of the Valley is derived from this 127 cms of rain falling on a catchment of 1.78 million hectares. Actual delivery of water into the streams, however, depends on the state of the ground on which it falls. In a ground having good vegetative cover about 95 per cent to 97 per cent of the heaviest rain is absorbed within the soil and then slowly released into the streams over a subsequent period. On the contrary, the same storm falling on bare ground or eroded area will discharge over 90 per cent of the storm in a sudden peak flood, which is naturally followed by early drying up of the streams. Such early drying up is particularly observed in the West Bengal portion of the Valley where vegetative cover is found to be meagre. It is, however, calculated that the average annual yield of water from the upper valley is about 0.88 million hectare metres which correspond to about 50.8 cms of run-off in a year of average rainfall of 127 cms. This is the total volume of water that runs down the river system and is available for utilisation."

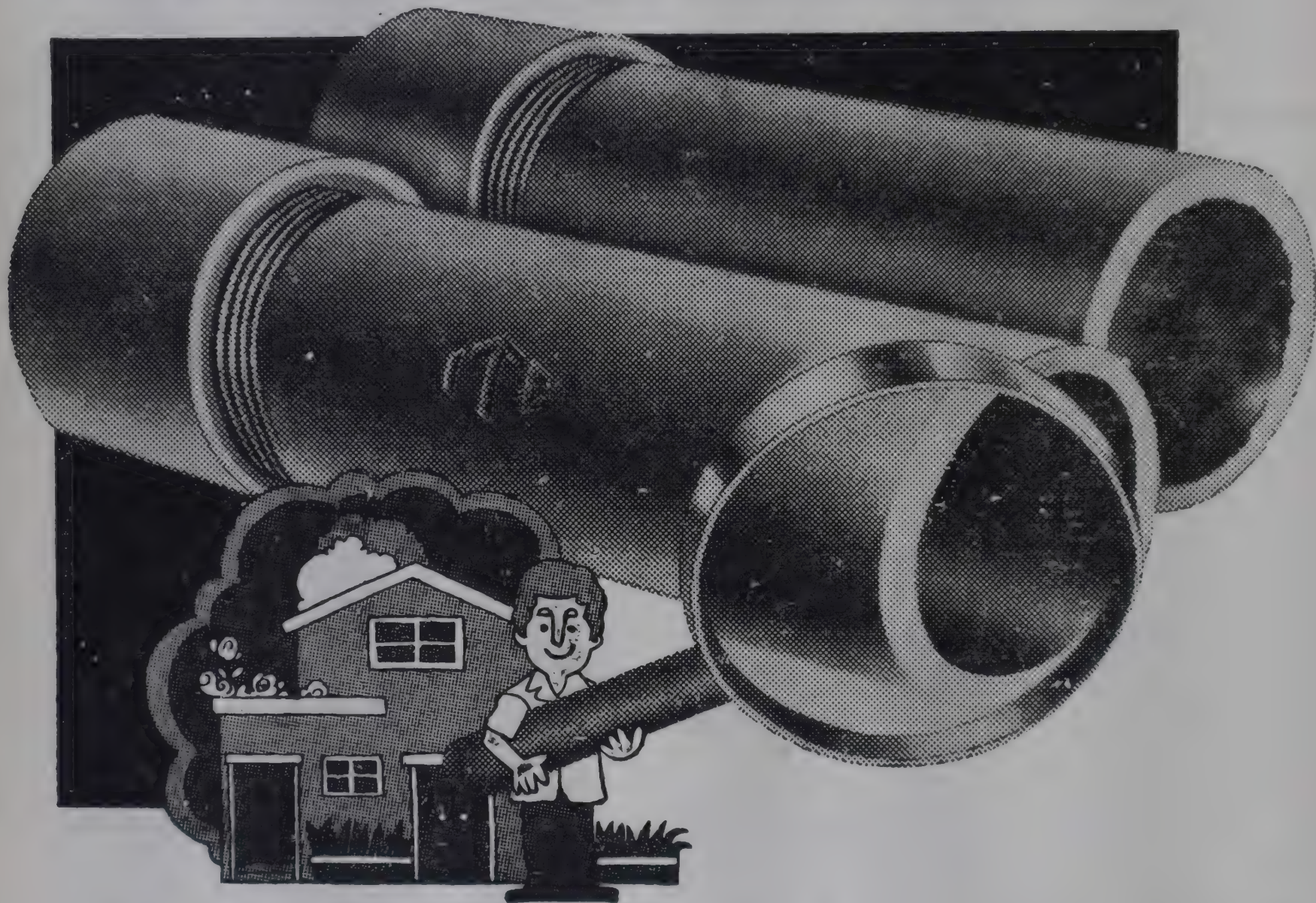
What is rather disconcerting is that our foresters, under pressure from agricultural and other interests, do not play their part in acting as custodians of the most important natural resource which has been placed in their hands. There is an increasing tendency for them to assume that modern technology makes it possible for them to make a forest play the dual, *productive* and *protective*, role simultaneously. In 1960 the Forest Research Institute organised an all-India symposium on our tropical moist evergreen forests. The first recommendation of this meeting reads: "Most of the

tropical evergreen forests of India are so located that their protective functions are of paramount importance. Consistent with this primary consideration, it is necessary to step up the productivity of the forests to the maximum possible extent." One fails to understand how this dual objective can be achieved, when we recall the statement by Merimanin quoted above. Even a slightly degraded forest ceases to act as a sponge and fails to absorb the total precipitation.

No doubt the participants of the symposium were forced to make this recommendation on the basis of the strong sentiments expressed by many foresters about the need to get the most tangible returns from our forests in the shortest possible time. A forester from Kerala stated: "The question of satisfying the acute land hunger and drawing maximum financial returns from land by cultivating cash crops cannot be ignored." He further stated that during the previous year the government was desirous of extending one lakh acres of rubber plantation in the evergreen forests, though till then only about 8,000 acres had been handed over for this purpose. According to him, in future all plantable land should be thus converted. There were few voices which saw the danger of converting forests into cash crops, or stemming the expanding hydro-electric and irrigation projects which lead to the destruction of so much forest land. Only one forester had the courage and the foresight to remark that "for the very existence of these projects preservation of the evergreen forests in the high hills is essential."

Some senior officials of the Ministry of Agriculture are now of the view that we must rely much more on our groundwater than on surface irrigation. Surface irrigation leads to the submersion of valuable land in the valleys, and the gigantic multi-purpose projects which are created to supply the irrigation network with water result in colossal destruction of forest resources. Since independence, 35,000 million rupees have been spent on major irrigation projects, and 20 million hectares are now being irrigated. On the other hand, the total groundwater potential is estimated at 35 million acre feet, and the present utilisation is only 15 million acre feet. Let us hope that the Land Use Commission which is in the making will be able to ensure an integrated use of our country's natural resources and to plan for conservation and development to go hand in hand.

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SOCIAL PRIORITIES FOR WATER

By Arvind N. Mafatlal

IT is now generally recognised that at least in our country water is no longer available in unlimited quantity. It is already a scarce commodity and, in terms of its requirement, it is destined to become more and more scarce. Of course, one can presume that hereafter many measures would be taken to increase the availability of usable water in India. But, even after all such measures are taken, water would continue to fall far short of our requirement. If in such a situation, we want to get the maximum benefit of our available water resources, we shall have to lay down the social priorities for allocation of water and ensure that these priorities are adhered to in practice in every village and every city of India.

Water belongs to community

While setting priorities for water, we must all start from the premise that water, irrespective of where and how it is available, is the gift of nature and therefore belongs to the entire commu-

nity. No individual or family can be allowed to claim that a particular body of water belongs to that individual or family as private property. This is not only a moral imperative but also a technological imperative. For, it is the unanimous opinion of all hydrologists that any worthwhile planning to maximise the benefit of water can be done only on a watershed basis; that is, all the water available in a watershed or a catchment area has to be treated as a single entity and the entire detailed water utilisation pattern has to be worked out on that basis.

If this moral as well as technological imperative is accepted, it follows that all water conservation works should be owned by some public agencies i.e., by some government organisations or co-operatives or public trusts. Only then will it be possible to implement the priorities of water use to which I shall now turn.

The first priority

The first priority should be to provide drinking water for human beings and cattle. On the face of it, this suggestion is so sensible that it may sound rather platitudinous. Yet, this issue

has to be raised and settled squarely because we find in practice today that in times of drought, when human beings and cattle suffer intolerable hardships, an enormous quantity of water is used either for agriculture or for industry or even for private gardens. As a result, the poor farmers of this country have lost hundreds of thousands of cattlehead—in most cases, their only property. Whole families have to set out in search of water in the early hours of dawn and return home by high noon with a few precious pots of water from wells or ponds after trekking 10 to 20 kms in scorching sun. Freedom, democracy or socialism has no meaning so long as this type of situation continues.

I therefore suggest that we should put a law on the statute book of the country laying down clearly that whenever there is shortage of water, first priority would be given to provide water for human beings and the cattle. This use should have priority over any other use, irrespective of the consequence. Besides, in respect of all drought-prone areas, the government should have contingency plans ready on the shelf as also a skeleton staff and equipment so that whenever there is

Mr Mafatlal is chairman of Shree Sadguru Seva Sangh Trust, which has been doing village development work in various parts of the country.

brought, a full-fledged machinery can be put into action immediately.

The objective should be to provide at least some minimum quantity of water almost at the doorsteps of every family throughout the period of drought.

This is the minimum social commitment which any Government should accept. Everything else should come next.

Water for agriculture

After this, the second priority should be accorded to agriculture. To be specific, whenever we are faced by a hard choice of agriculture vs industry, without any hesitation priority should be given to agriculture, which is the mainstay of the Indian economy and the very life of the people of India.

Even within the broad priority for agriculture, we should clarify some further priorities. Thus, within any particular region, the first priority should be to ensure one basic crop—kharif or rabi according to the prevailing cropping pattern of the region—to every farming family. In other words, there should be no question of providing water for a second crop or a long standing

crop like sugarcane to any one until and unless water for one basic crop has been assured to every farming family within this region.

Here, of course, one would have to face the issue of defining a region and delimiting its boundary at the ground level. Any delimitation is bound to be somewhat arbitrary. But, subject to this qualification, any area, within which it is possible to convey water from one part to another by practicable means, may be defined as a region for this purpose. Without such a delimitation of areas it might, in practice, prove impossible to implement the priority suggested here.

It may sometimes happen that in a particular region we may not have sufficient water to assure even one basic crop to all the farmers. Then, how should we go about allocating the available limited supplies of water? In such a situation I would like to suggest that we should ration water. That is, we should fix up some minimum allocation for every family irrespective of the size of cultivable land operated by the family. Thus, for example we may decide that we may give to each family sufficient water for one acre of food crop and one acre of fodder, so that

some minimum standard of living assured to every family even under scarcity of water. The figure of one acre which I have suggested need not be taken too rigidly. According to the prevailing soil and climatic conditions the local authorities may arrive at somewhat different figure provided the basic idea of rationing and provision of some minimum standard of living is firmly kept in view.

Power stations should stand next in priority. Any surplus available may be allocated to various industries and services. Here, the industries and services catering directly to the needs of the common people should be given the first priority. Those which cater to their needs somewhat indirectly should rank lower in priority.

Need for action

Issues relating to priorities allocation of water have been the subject of general discussion for quite some time. I think I am voicing the feelings of the many in the country when I say that the time has now come to take action. The government should move quickly to take basic decisions on this matter and set up the relevant organisational structure to ensure the implementation of these priorities.

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Rural thirst unquenched

By B. G. Verghese

THE spectacle of local belles with gleaming brass pots drawing water from the village well has long symbolised the romance of rural Indian life. It does make a pretty calendar picture. But the underlying reality is often one of water-borne disease and periodic distress or migration when the wells turn muddy and run dry in seasons of drought and famine.

"The provision of a safe and adequate water supply is a basic requirement and should receive the highest priority": Thus said the First Five Year Plan, 1951. Nearly 25 years later, the Draft Fifth Five Year Plan noted: "Given the magnitude of the problem and the constraint of resources, only a small dent has been made on the overall problem". According to the Planning Commission, the programmes undertaken during the first four Five Year Plans have provided water supply to nearly 36,000 "difficult villages". Under the Fifth Plan, it is hoped to cover the remaining 116,000 "difficult and problem villages" as part of the national minimum needs programme.

The Second Plan document observed that "water-borne and other allied diseases are responsible for a large incidence of mortality and morbidity in the community which can be brought under control by establishing protected water supplies and sanitary methods of excreta disposal". Under the Fourth Plan, special emphasis was placed on providing protected water supply to endemic cholera and filaria zones. The urgency of making available both adequate and safe water supplies has been well understood and repeatedly stated from one Plan to the next and from one policy pronouncement to another. But, despite the setting of the most austere standards—a ceiling of Rs 10,000 per village was prescribed at one time with an expectation of a 50 per cent public contribution—what has been attempted is modest and the achievement even more so. The basic necessity of providing adequate and then safe water supplies naturally must take precedence over the convenience of piped distribution.

Unfortunately, water supply programmes had long come to be regarded as a low plan priority and

expendable welfare package and no part of the core growth programme. This was a mistaken view. For, safe potable water, like nutrition and basic health care, is a critical investment in man and a determinant of the health, stamina and efficiency of the nation's manpower. A new awareness is, hopefully, evident. The other error, as in much of the community development movement, has been to make this a hand-out programme from above instead of seeking to encourage genuinely community effort, official support largely turning on inputs of social education in creating an awareness of the need for safe drinking water and environmental sanitation and in buttressing motivation with design and other technical assistance. Not that State finance is unnecessary; but rather that this be deployed differently.

Urban bias

Environmental sanitation, more particularly drainage and sewerage, must go hand in hand with water supply programmes. Else, not only is there a danger of water sources being contaminated but of aggravating disease. Yet, such is the magnitude of the task to be undertaken, whether in terms of organisation or finance, that the Government has shied away from tackling it more boldly. Earlier cost computations, running into hundreds of crores of rupees, have awed and demoralised planners and conditioned them into thinking small. Maybe, there is also something to be gained from searching for more appropriate technologies in finding solutions for a problem of staggering dimensions.

It is no surprise that urban water supply and sanitation programmes should have received far more attention and finance than corresponding rural programmes and that the States should have diverted resources allocated to the latter to the former. This is part of the urban bias of the Indian elite which is reflected in its administrative, professional and even political concerns. As against Rs 44 crores spent on rural water supply programmes during the first three Plans, the corres-

ponding outlay on urban water supply schemes was of the order of Rs 182 crores. The fourth Plan figures are estimated at Rs 162 crores and Rs 280 crores respectively. This urban bias was corrected in the draft Fifth Plan. But what the trend of actual expenditure has been is not known as yet.

International agencies have begun to show a growing interest in water supply programmes and UNICEF has, for instance, been committed to a substantial hard rock drilling programme since 1967, the year of the Bihar famine.

The World Bank is funding large water supply programmes in Uttar Pradesh and Andhra Pradesh. The UP water supply and sewerage project envisages the establishment of an autonomous water board, the Jal Nigam, with eight regional water authorities or *jal sansthan*s. Three rural *jal sansthan*s will provide piped water supplies to 1.2 million people in 2,000 villages in 'hardship' areas such as hill regions and chronic scarcity areas. The water will be drawn from surface sources, springs and groundwater, with water treatment plants where needed. On an average it is expected to provide one standpipe per 200 persons in each village with house connections to those willing to pay the tariff.

Bamboo tubewell

Several States are setting up autonomous water boards which are intended to operate on commercial lines. This has organisational advantages and could give an impetus to rural water supply programmes.

Over 118 UNICEF rigs are in operation in hard rock areas. But, while the technology has been transferred, the problem of delivery of water remains. This primarily revolves around the design and maintenance of a suitable hand pump that is both cheap and rugged. Individuals are careful with hand pumps. But a large percentage of community hand pumps is reportedly out of order and taps are removed or left running.

The hard rock drilling programme has significantly lowered the unit cost per capita of making available a safe water supply. Water is usually struck at a depth of 100 to 200 feet in hard



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regions and requires no treatment, which would otherwise add to the cost it does to that of surface water. In the alluvial tracts, on the other hand, subsoil water in shallow, permeable zones may be contaminated or polluted. It is, therefore, necessary to go deeper, to the aquifers, for pure and plentiful supplies.

In North Bihar, the indigenous 'bamboo tubewell' is an example of the type of appropriate technology can play. It is simple, inexpensive, dependent on local materials and skills, and quick. Not that there may not be problems elsewhere too. If so, this obviously requires supportive R&D effort.

Infrastructure

The village potter could be trained to diversify into the manufacture of clay water pipes, drainage channels, and latrine pans from suitable moulds. This again could facilitate the use of local materials and skills and create local employment while keeping down programme costs, including those of transport of materials over long leads. Local technology, being better understood, would probably be better maintained and would, in any event, be more easily replaceable.

There is ample evidence to show that, properly motivated, most Indian villagers are able and willing to raise local resources of money, materials, and labour to build and maintain local community assets. If the village has funded its own water supply scheme, it will make doubly sure that it is carefully maintained. Local pride and local responsibility will combine to ensure this result.

Certain water supply and other programmes may, however, be beyond the capacity or reach of a single village. In which case, would it be feasible to group five or ten villages, more or less, in order to exploit local factor endowments to best advantage or to ensure more efficient, low-cost solutions? Certainly in North-Eastern India, the typical Naga, Mizo, or Arunachal village is so tiny and dispersed, with small hamlets widely distributed on different hilltops, that no meaningful water supply or other development programme is possible without the grouping of villages into viable units of a minimum size which alone will justify the cost and the infrastructure involved in providing water.

In certain parts of the country, windmills could perhaps be employed to lift water to elevated reservoirs or simple overhead tanks that permit gravitational distribution. Here again,

the problem would be to design inexpensive windmills appropriate for varying wind speeds from region to region.

According to a national sample survey (1963-64), about 66 per cent of India's 545,000 villages drew their drinking water supplies from (shallow) wells and almost another six per cent from tanks and ponds. These are vulnerable sources and easily contaminated. Pending the provision of improved alternative sources, if any, the only answer lies in protecting these wells and ponds through environmental sanitation and drainage schemes and by means of simple chemical treatment of the water sources themselves. Asking the villagers to boil the water would be to make an almost impossible demand in view of the costs involved and the paucity of fuel. Community action could, however, again make this possible in some cases at least.

Challenge

Just as television, and to a lesser extent even the radio have been instrumental in lowering if not breaking some taboos and encouraging social integration in village communities, so can rural water supply programmes. The demarcation of villages into distinctive caste settlements, each with its own neighbourhood well or wells, has main-

tained caste and community differentiations. Harijans draw water from Harijan wells, Jats from Jat wells and so on. But just as village schools and, more so, school (and famine) feeding programmes promote inter-caste and community dining, the provision of community drinking water sources for whole villages or groups of villages would cut across existing 'water-barriers'. This might be an incidental gain from rural supply programmes, but is nevertheless a useful dividend to earn on the side.

The more immediate task, however, is to motivate and organise the rural community for action in fulfilling an already felt need. Voluntary agencies have been active in this field but possibly have a more positive, innovative role to play in this and other areas of rural development. Indeed, the provision of a safe and protected water supply could be a valuable focal point for voluntary action as a catalyst to local community effort.

Here is a challenge as much to the voluntary agencies and urban institutions with a social conscience as to the Central and State governments. With growing population, the solution of the problem, already too long neglected, brooks no further delay.

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Drinking water for the villages

By K. K. Khatu

MAN has a certain physiological need of water to survive. Beyond this more water would improve his health and well-being. Although the desirable proportion of water in a human body is around 70 per cent of its total weight, a man's daily water requirement remains to be around 7 per cent of his body weight, unlike the camel for whom it is 1 per cent only. No wonder that a man under physical strain demands more water. He requires a constant supply of water for the maintenance of his body temperature. Therefore, his water requirements are to be met irrespective of his habitation.

In retrospect

Water required for drinking is obtained in different ways according to habits of human life and natural conditions during different stages of human development. During the primitive stage, man used to wander in search of food and to satisfy his water needs by settling near a river or a lake. Our Aryan ancestors, more than 10,000 years ago, preferred to build their homes on the banks of large rivers where good supplies of water were available throughout the year. Occasionally, philanthropists and wealthy people took interest in providing drinking water facilities to poor people. Some of the great emperors, Hindu, Buddhist and Muslim, made their names immortal by providing such conveniences. Maharani Ahilyabai Holkar of Indore who provided wells and ghats throughout India is

Dr Khatu works with Operations Research Group, Baroda.

the most renowned lady in this respect. The construction of rest houses, *sarais*, at a distance of every two *koses* (four miles) on the great roads built by Sher Shah in the 16th century are well known¹. In every *sarai* he had placed pots full of water so that anyone might drink, and also made arrangements for providing a traveller (and his horse) with food, shelter and water, both hot and cold. The Maharaja Sayajirao of Baroda had carefully planned the rural water supply schemes and implemented them as early as in 1892². Not only did he have plans of constructing wells in each village but he also set aside funds for the water schemes exclusively planned for the rural cattle and for meeting the drought conditions. While planning relief works during the drought conditions, he emphasised programmes like digging wells, construction of dams, canals etc. Today, on a large scale, serious efforts are being made and funds are being provided by various agencies to solve the rural water supply problem in the country.

Water supply systems

A large quantity of water has been stored up in the nature either in gaseous, liquid or in solid form. The gross quantity available is, however, not ideally distributed in time and space. Moreover much is unavoidably lost. It is estimated that for each square centimetre of the earth's surface there are 273 litres of water distributed³. But of this, nearly 93 per cent water is unsuited for drinking purposes unless very heavy costs are incurred for its purification processes. Water that is present at any moment

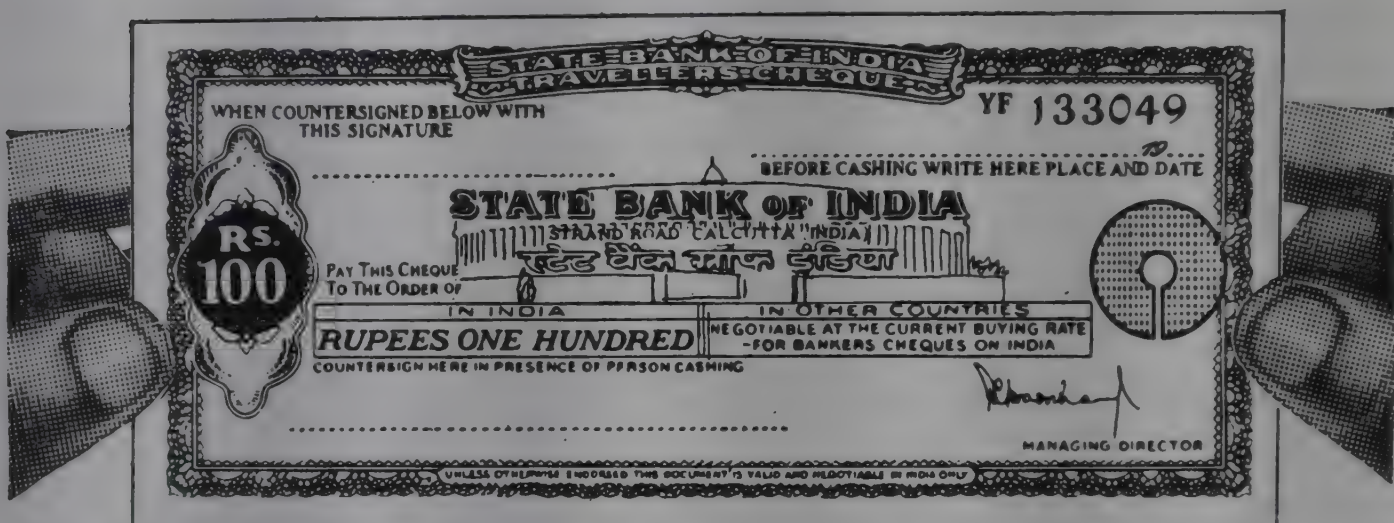
in springs, streams, rivers and lakes is a small portion of the water available on land. Therefore, water supplies have certain limitations viz., (a) the rainfall characteristics and the quantity of water available in any region; (b) water quality; (c) the varying water consumption pattern and (d) its limited interchangeability.

Basically, there are two types of water supply systems—natural and protected. Most of the natural systems fall under uncontrolled situations, while the protected systems are under controlled situations. Some sources have limited expansion, and, therefore, have limited scope. But the flows and large stores of water have always been used widely and for variegated purposes. All the water sources have limitations of availability, dependability and accessibility. Depending upon the distribution, utilisation and purification constraints the quality and quantity of water supplies are determined. However, the management skills, technological development and the financial assets available at any point of time would govern the scope of the water source. More importantly, consumers would examine the cost of water when it reaches them (See diagram Water Supply System).

Sources of water supply

From trickling water through springs to large flows of million acre feet of water through big rivers, all kinds of water sources are present in our country. There are areas of diversified problems viz. waterlogging, desert, flood, brackish water etc. Except in mountainous areas, springs are rare.

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Moreover, they cannot satisfy the needs of a large number of people. Some of them are hot water springs with sulphur content and are often unsuitable for domestic consumption.

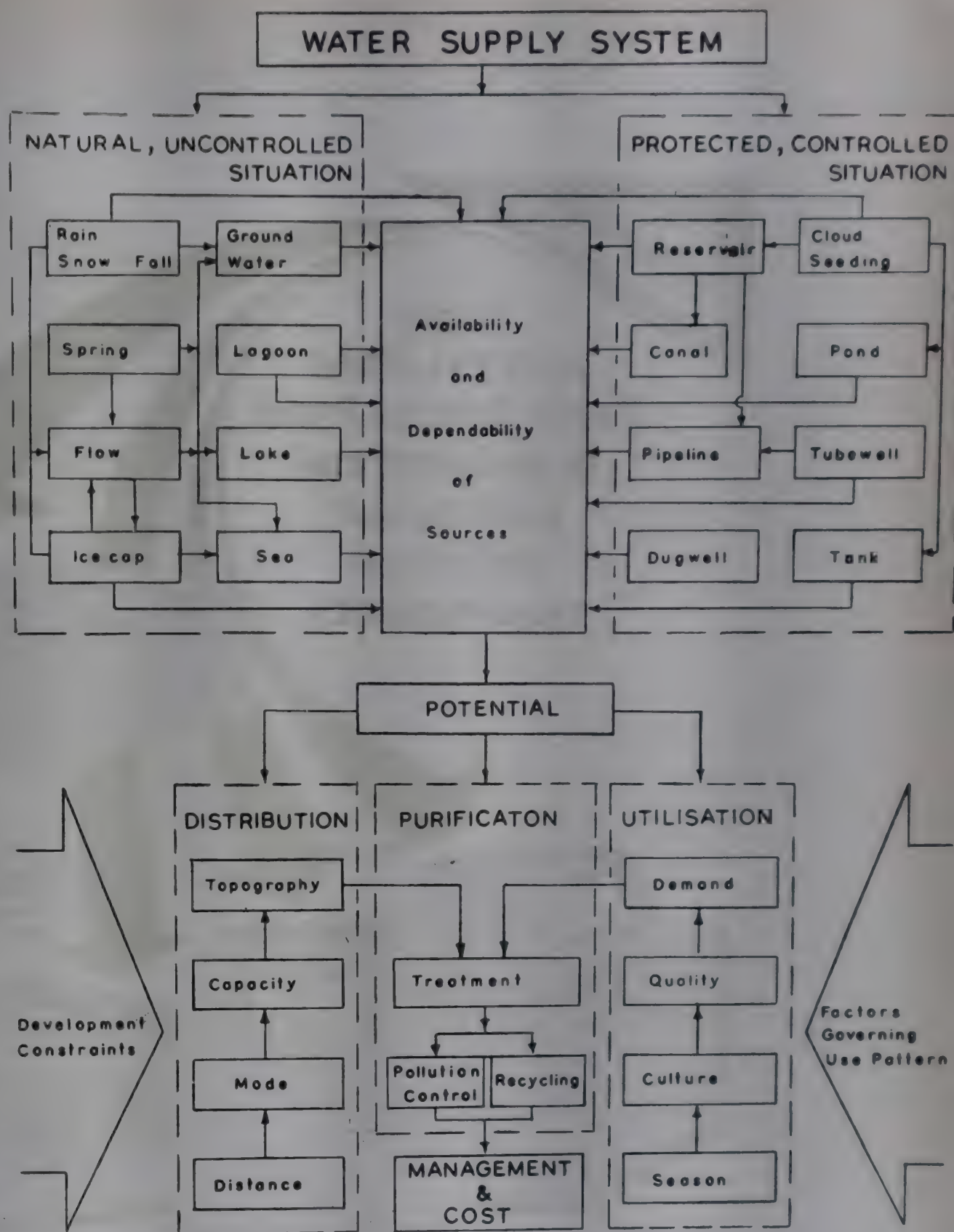
The rivulets, streams and other natural flows of various magnitude have been in use since the nomadic days of the human race. The seasonality of flows and quality of water therein during floods and the dry season restrain their use. Along the sea coast, tides come up the rivers to some distance upstream from the mouth, and estuaries are formed, thus making river water saline. The people, therefore, preferred to settle at choice-locations. Today, most of the villages are dependent on wells. Occasionally they supplement it by fetching the water from nearby sources like rivers, ponds, tanks etc.

Being sub-soil water, the well water is cleaner than stagnant water in a pond or a tank. In the case of a deep well where water is tapped from below the upper impervious strata, it is pure. Sometimes this water gets charged with dissolved impurities and becomes hard water. Tubewells are fast becoming popular in rural areas as this could be the best assured supply of pure water. However, the subterranean water can have problems of dissolved solids in it. In the districts of central Gujarat the dependence on tubewell water supplies is quite high and is still increasing in spite of high ppm. values of groundwater ranging from 1,000 to 2,000 and varying from season to season. Artesian wells have a good quantity and a good quality of water. But they are very rare. In South India such wells are said to be 2,000 feet deep. The best existing artesian well is near Viramgaum in Gujarat, where the depth of it is 311 feet and the water available per day is 5,76,000 gallons⁴.

Table 1 : Multiple-sources of water in villages
(A case of Ratnagiri District in Maharashtra)

Type of source	Per cent villages	Type of source	Per cent villages
Well ..	85.23	River ..	21.95
Canal ..	12.04	Nullah ..	8.16
Tank ..	4.66	Spring ..	2.13
Pond, pit ..	2.13	Stream ..	1.48
Reservoir ..	1.42	Pipeline ..	1.29

(Percentages do not add up to 100 because of conjunctive use pattern in the villages).
SOURCE : Census of India — 1961.



Ponds, tanks, lakes, reservoirs etc. are the other types of drinking water sources available in rural areas. But here again, the seasonal fluctuations in water availability are high, and dependability varies from source to source. Moreover, the quality of water is affected as its quantity reduces. There are a few lakes constructed by human agencies. Karnataka State abounds in such tanks, but their value as water supply sources for human consumption is yet limited because most of them become dry in summer.

The modern methods of assured and controlled water supplies through pipeline, canals, tubewells etc. are still lacking in rural areas, and, therefore, the villagers often prefer a conjunctive use of water. They depend mostly

on dug wells for drinking and cooking water needs, but for other domestic water needs they rely on ponds, tanks, rivers, etc. The water sources other than wells appear to be supplementary (See Table 1). Obviously, in such circumstances, little attention is paid to hygienic values.

Situation in India

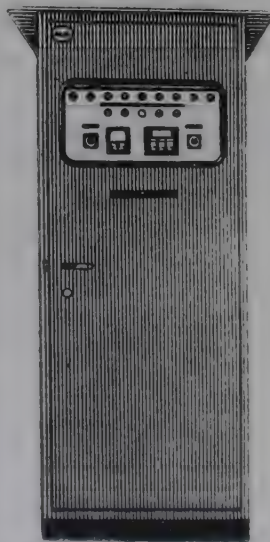
In a tropical country like India, there is a considerable loss of water due to evaporation. The cloudless sky and bright sunshine for about 11 hours a day during summer months further aggravate the problems of water scarcity. Most of the natural sources like streams, wells, tanks, springs etc. become dry or are left with muddy unpotable water.

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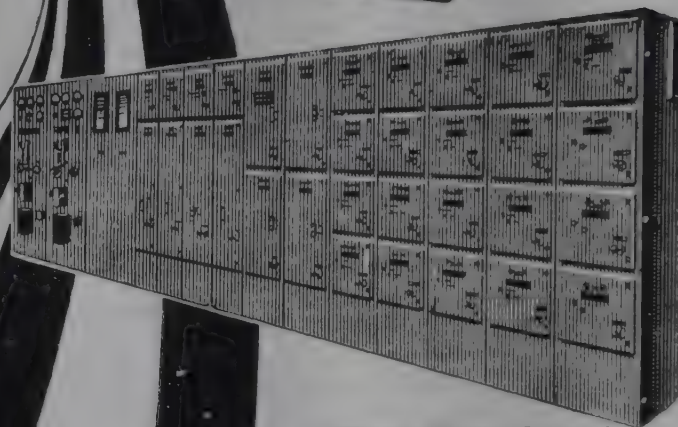
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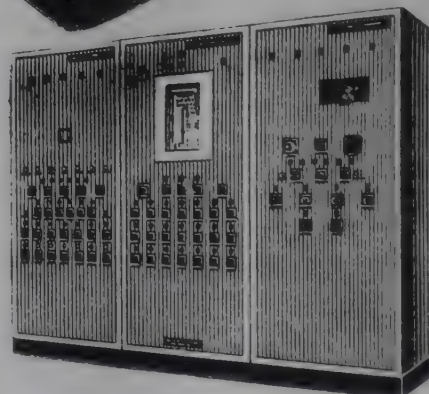
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Often village-sites are above the normal maximum flood level and also at a considerable distance from the river bed. During summer months the flows dwindle, and water is carried as a headload generally by womenfolk. The steep sloping banks of the river increase the exhaustion of the women carrying the headload of water to the village site from the bed of the river. During the monsoon the slopes become slippery and hence risky too. The building of ghats along the rivers, therefore, has been considered an act of benevolence. As regards tanks and lakes, a few located in foothill areas, where the mountain ranges drain water into them, hold water even after the monsoon period.

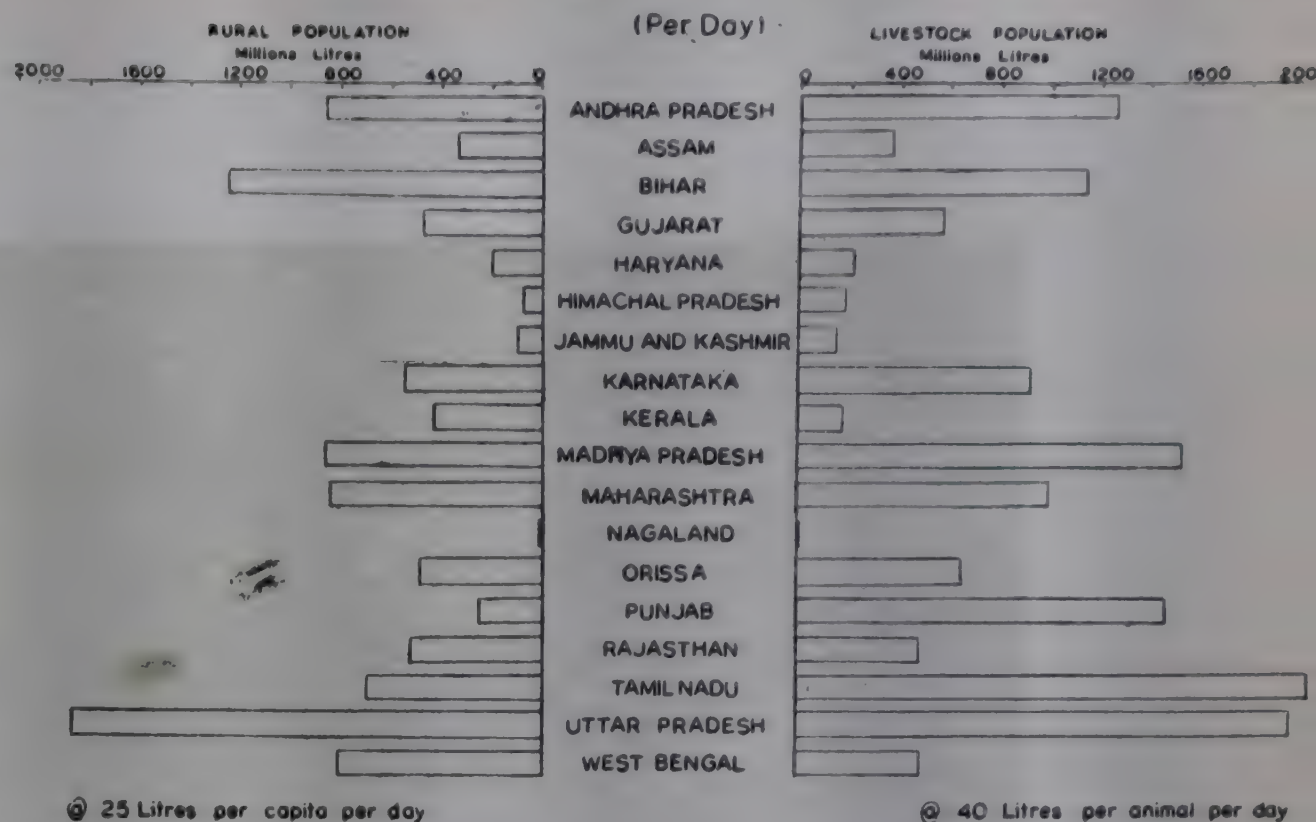
Prior to 1947, efforts to supply water in rural areas in the country were spasmodic and the progress was also haphazard. During the First Five Year Plan period (1951-56) the provision for water supply schemes in the States was part of Community Development Works and Local Development Works⁵. Only in 1954 the Union Health Ministry included a water supply and sanitation programme as part of health schemes under the plan. Under this programme, only piped water supply to a group of villages from a single source or multiple sources was included. The rural water schemes were then limited to: (i) National Water Supply and Sanitation Programme; (ii) the Community Development Programme; (iii) the Local Development Works Programme; and (iv) the Programme for the Welfare of Backward Classes.

Scarcity areas

Of late, every State has been making a careful study of the water supply situation in rural areas. The Government of Gujarat has recently carried out a detailed survey of the sources of water supply in villages, and subsequently steps were taken to improve the same, wherever necessary⁶. The State government during the past decade approved the piped water supply schemes for some 1,000 villages including those in scarcity areas. It is expected that by the end of this decade the State may achieve its target of providing safe and potable water to about 3,000 villages which are categorised as no-source villages⁷. Due to the failure of monsoon for two consecutive years in the State a master plan costing Rs 182.00 lakhs for 119 villages was prepared to tackle the situation.

In Himachal Pradesh, by the end

NEED FOR SUPPLY OF WATER



of the Fourth Five Year Plan, the provision of drinking water was made in 2,837 villages having a population of 7.78 lakhs⁸. During the current year it is expected that another 100 villages with a population of about 32,000 will be provided with drinking water. The State Department of Community Development takes up only minor works like renovation of water springs and construction of dug wells. In addition, it executes small water supply schemes costing up to Rs 25,000 in villages with either no water supply or inadequate water supply.

The government of Tamil Nadu set up the 'Tamil Nadu Water Supply and Drainage Board' in 1971 in order to have a single and unified agency to look after the water supply and drainage schemes both in urban and rural areas⁹. In Maharashtra, the target is set to have at least a well in each village; *Ek gaon ek panvatha*. The schemes of providing assured and safe water to the inhabitants in villages has now been given top priority, especially in areas of scarcity and inadequate water supply. There is a considerable need for augmentation and improvement of water supply in rural India. Nearly 1.16 lakh villages in the country with a population of about 61 million do not have even the most basic need of the life¹⁰. During the period of the first three Five Year Plans about Rs 130 crores were spent on village water supply schemes. However, against the approved outlay of Rs 125 crores for rural water schemes, the States and Union Territories have

spent about Rs 162 crores, during the Fourth Plan period. Thus nearly 36,000 difficult villages, accommodating about 21.6 million people have benefited.

It is not possible to consider the drinking water needs in isolation because it is one among many components of the domestic use of water. Therefore, it is difficult to estimate the water requirements of any settlement or a region. The climatic variations in temperature, surface configuration, religious and social customs, habits, advance of civilisation and values of hygiene are some of the factors that must be taken into account when we consider the demand for water. But for having a rough idea some norms could be laid down based on the general observations in rural India and the minimum level of development towards water facility provision envisaged.

Rural population and water needs

The supply of drinking water in villages is normally 10 to 15 litres per capita per day as against 25 to 50 litres per capita per day in urban centres. However, the rural water supply schemes are generally designed on the basis of 45 litres of water per day per head¹¹. In places where the cost of drilling wells in difficult terrain is high and available sources are not plenty, the per capita consumption may be restricted to 25 litres per capita per day. Water needs of cattle and other domesticated animals should be estimated since they share the drinking water from the same source.

About 80 per cent of the population in India lives in rural areas, and



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during this decade alone it has grown by about 22 per cent. This population, which was two decades ago spread in 5.58 lakh villages, is now dispersed in 5.76 lakh villages. This means that there is an addition of 900 new villages on an average every year. However, this does not account for the upgrading of a few villages in the urban category. The problem of providing potable water to the rural population has become more complex because of a large number of small villages in the country. Nearly 95 per cent of the villages have each a population of less than 2,000; while about 62 per cent of the villages fall in the category of less than 500 population (See Table 2).

The water used for domestic purposes is only 3.6 per cent of the total water used for various purposes, viz. industrial, commercial, steam and electric power, public-municipal, agriculture etc. The rural people in general make much less use of water for domestic purposes than urban people. While estimating the water needs of any rural region a few points are to be considered; namely, who and how many are the users? When, where and how do they use it? The answers to these questions would decide the water use pattern of the region. However, it is easier to estimate the needs by fixing a ratio between population and water source, or between village and water source. This would mean that for all sources the water yield rate has to be presumed equal or an inter-source relationship could be established. In the absence of detailed data on water yields by various sources the estimation of water needs could temporarily be expressed by the unit of well. Any rural water supply scheme has basically three dimensions, the area, the population and the locations that needed to be served by it. Therefore, in the existing set-up, the population-well ratio with reference to village distribution can be relied upon to measure the adequacy or inadequacy of drinking water facilities in any region. However, the application of such ratio would serve only broad objectives since it ignores the existence of other sources on which the rural population is partially dependent. The estimation of safe water yield from the source is another difficult task. Therefore, a minimum provision could be constructing a well for each village, while the other criterion could be at least a well for some fixed number of population. Demand of water normally goes on increasing with its purity and also the

Table 2: Need for water (Settlementwise)
(A case for Gujarat and All India)

		Size of settlement	Per cent inhabited villages	Average population per village	No. of source points (wells) required
India	Less than 200 persons		31.2	100	1,76,380
Gujarat			17.2	113	3,200
India	200 — 499		30.7	332	3,46,370
Gujarat			28.5	343	10,600
India	500 — 999		21.1	704	4,76,790
Gujarat			28.5	714	21,200
India	1000 — 1999		11.6	1,370	4,57,160
Gujarat			17.8	1,367	23,110
India	2000 — 4999		4.7	2,887	3,95,400
Gujarat			7.2	2,889	19,980
India	5000 — 9999		0.6	6,530	1,12,070
Gujarat			0.7	6,308	4,510
India	Above 10,000		0.1	15,841	6,11,440
Gujarat			0.1	12,251	4,280
India	Total		100.00	636	22,58,870
Gujarat	Total		100.00	824	92,920

NOTE : (i) The number of sources needed is inclusive of sources existing.
(ii) Estimation is based on a well for every 200 persons.

ease with which it is available. Therefore, about 25 litres of safe water (requirements are on the conservative side) could be considered adequate supply for a rural inhabitant. Similarly, for an animal it could be around 40 litres. However, the ideal could be something around 60 litres per day per head for the rural inhabitant¹².

Interestingly, the three districts namely, Anantpur in Andhra Pradesh, Ratnagiri in Maharashtra and Kaira in Gujarat (which differ physiographically and climatically) have today quite an equal number of population; however, their population-well ratios distinctly differ: 550, 1,380 and 2,100 persons per well respectively. The high dependence observed in Kaira and Ratnagiri seems to be a fallacy, as the districts have many other sources of safe water. Especially in Kaira, the well water yield is pretty good, and it has also high recuperation capacity. Therefore, the consideration of the type of source and its usefulness becomes important in estimating the village water potential, as otherwise a blind-fold approach may distort the picture and thus hamper

getting to grips with the real problem. As the population in the country is not uniformly distributed, the demand for drinking water in different States could also be quite dissimilar. Moreover, the availability of sub-soil water (after irrigation use) is also unequally distributed in the country. Therefore, with the limited ground water resources the drinking water needs of the rural population are to be met in each State. Drinking water needs of Madhya Pradesh, Bihar, Uttar Pradesh, Orissa and West Bengal are quite high. However, these States possess sufficient groundwater potential to meet the situation. While Gujarat, Rajasthan, Maharashtra, Mysore and Tamil Nadu have comparatively less groundwater recharge available to meet their respective drinking water needs (See Table 3).

Water needs of livestock

The livestock population in the country is, by and large, concentrated in rural areas and it shares the water facilities along with the rural people. It is, certainly, not desirable to burden the sources of safe water supplies. Moreover, it is unhygienic also. The

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livestock population of the country today is around 34.8 crores (excluding poultry). It means for every five rural inhabitants there are four domesticated animals in the country. The estimation reveals that the livestock share, in the total water needs for drinking and domestic purposes in the country, is around 66 per cent even when it is based on a conservative standard of 40 litres per animal per day (See diagram). A large-scale migration of cattle from drought-prone areas of Kutch and Saurashtra to sub-humid regions of South Gujarat is not uncommon especially during the years of monsoon failure.

Water-borne diseases

Many of the rivers, lakes and tanks in India which are treated as holy *tirthas* are often visited by pilgrims. During the season of pilgrimage the water in them is contaminated due to indiscriminate use by pilgrims. The water that is used for drinking purposes often spreads epidemics like cholera and other diseases. Cholera is endemic

in the States where environmental hazards (drought, floods etc.) are frequent. The National Cholera Control Programme has taken up the task of improvement of the environmental sanitation, particularly safe drinking water supply and the disposal of sewage, on a priority basis, in the cholera endemic areas of the country. During the Fifth Plan 54 cholera combat teams will be established in the country¹³.

Besides cholera, other principal water-borne diseases are typhoid fever, amoebic dysentery, diarrhoea, gastroenteritis, bilharziasis, guinea worms and enteric diseases. In dry and desert regions where the water is scanty and often hard, the kidney stone diseases are common¹⁴. Chemical tests are, therefore, required to indicate the amount of solids in the water. Iodine in the form of iodides in a concentration of 0.005 mg/l is beneficial to health as it guards against goitre (enlarged thyroid), while a fluoride concentration greater than 1.5 mg/l causes the enamel to be mottled¹⁵. In fact, pathogenic bacteria which vary in sizes from about 1 to 4 microns cause the diseases.

A sample health survey carried out some 15 years ago in Gujarat State revealed that about 46 per cent children in the villages had mottled teeth¹⁶. Similarly, the survey also revealed that the fluoride content was usually around 7.00 as F(ppm) in the water, whenever the well was either near the cattle pond or a neglected pond. Every year 1 per cent of the rural population of Sabarkantha district was then observed to be affected by guinea worm. Such a high incidence of various water-borne diseases is even today not ruled out for rural India.

Water purification standards

Every water system needs some kind of water purification. To be safe for drinking, water must be pure from disease-producing bacteria (pathogens). In addition, water should have good taste, odour and colour. Also it should be free from turbidity and undesirable chemicals. Various methods are in use to make the water safe, viz. plain sedimentation, filtration (disinfection also) and aeration. The type of treatment required depends on the physical, chemical and biological characteristics of the raw water. Water from deep

Standards for drinking water

Characteristics	Permissible	Excessive but tolerable under unavoidable situation
Turbidity .. (mg/l on Silica Scale)	5	25
Colour (Units on Platinum Cobalt Scale)	5	25
Taste and Odour .. PH ..	Nothing disagreeable 7.8 to 8.5	6.5 to 9
Total solids (mg/l)	500	1500
Total hardness as CaCO ₃ (mg/l)	300	600
Calcium as Ca (mg/l)	75	200
Magnesium as Mg (mg/l)	50	150
Iron as Fe (mg/l)	0.3	1.0
Manganese as Mn (mg/l)	0.1	0.5
Copper as Cu (mg/l)	1.0	3.0
Zinc as Zn (mg/l)	5.0	15.0
Chlorides as Cl (mg/l)	250	1000
Sulphates as SO ₄ (mg/l)	250	400
Phenolic substances as phenol (mg/l)	0.001	0.002
Fluorides as F (mg/l)	1.0	2.0
Nitrates as NO ₃ (mg/l)	20	50
Arsenic as As (mg/l)	—	0.2
Chromium as hexa - valent Cr (mg/l)	—	0.01
Cyanides as CN (mg/l)	—	0.01
Lead as Pb (mg/l)	—	0.1
Selenium as Se (mg/l)	—	0.05

SOURCE : Handbook on Rural Housing and Village Planning, N.B.O.; Ministry of Works, Housing and Supply, New Delhi, 1968.

wells, for example, is usually free from pathogenic bacteria, and no purification is necessary. In many parts of the country the water is used untreated till it becomes unacceptable because of its colour, taste and odour. Some village authorities use chlorine and potassium permanganate to improve the quality of water, if the storage is small. However, this could be more useful if done immediately after and before the fair or bazar day in the village.

Sometimes the remedy is also suggested to regulate the use of river water by zoning the river-bed, i.e. by reserving the use of water in a particular section of the river-bed for a particular purpose¹⁷. This would avoid to some extent the contamination of water particularly when the river is flowing through the residential areas of villages or towns.

Similarly, the contamination of water due to vegetable and animal wastes and decaying organic material in the surface soils near the village-

Table 3 : Water needs of rural population and groundwater potential in States

State	Net ground-water recharge available (after irrigation)	Area in sq km per 200 rural population	No. of wells needed to be dispersed
	M.A. ft.		
Andhra Pradesh	13.6	1.58	17,500
Assam ..	16.7	1.46	68,490
Bihar ..	19.5	0.69	253,400
Gujarat ..	6.1	2.04	95,900
Haryana ..	2.7	1.07	40,990
Himachal Pradesh ..	N.A.	3.52	15,910
Jammu and Kashmir ..	4.0	11.77	18,860
Kerala ..	5.4	0.44	89,070
Madhya Pradesh	22.5	2.56	174,400
Maharashtra ..	9.2	1.78	173,160
Karnataka ..	9.0	1.73	110,740
Nagaland ..	N.A.	7.33	2,320
Orissa ..	15.8	1.55	100,600
Punjab ..	3.6	0.97	51,310
Rajasthan ..	1.4	3.23	105,970
Tamil Nadu ..	8.0	0.91	143,280
Uttar Pradesh	17.6	0.77	379,980
West Bengal	15.7	0.53	167,560
Union Territories ..	N.A.	2.70	25,940
All-India ..	170.8 + N.A.	1.11	2,035,460

NOTE : It is presumed that a well serves 200 people.

The number of wells needed to be dispersed includes existing wells.

SOURCE : Report of the Irrigation Commission, Vol. I. Ministry of Irrigation and Power, New Delhi, 1972.

is very bad, as the situation causes the breeding of germs of diseases and thus causes periodical epidemics. The washing of clothes, cleaning of utensils and bathing near drinking water source is a common thing in any Indian village. This further aggravates the problem of water pollution.

The two types of impurities, inorganic and organic, in the water, necessitate the treatment of it for making it acceptable for human consumption. The impurities found in the water are classified as dissolved, suspended, colloidal and micro organisms. Similarly, the water quality is described as: pure water which is free from objectionable matter; safe water that is potable water with no pathogenic germs; clear water with no suspended impurities; colourless water; and polluted water with no impurities from sources like drains, manure heaps, wastes, farms etc.

The Committee on Public Health Engineering Manual and Code of Practice (Government of India) has laid down the standards for purity of drinking water. Generally, the limits designated under 'permissive' are for ideal situations, but the tolerance limit is also given in the case of non-availability of permissible quality of water. However, beyond 'excessive' limits, water is not to be used for drinking purposes.

Desalinisation of water

Due to scarcity of water especially in desert and dry areas, people started experiments on sea water, so as to make it acceptable. Although sea water is available in plenty, it has dissolved salts content of over 30,000 mg/l. Moreover, many groundwater supplies especially near coastal areas are brackish and are not acceptable for consumption unless treated or mixed up with fresh water supplies. There are many processes that exist today to make such waters acceptable for human consumption. Distillation, freezing, demineralisation and electrodialysis are important ones. However, the exorbitant cost of these processes forbids their use. Near Bhavanagar in Gujarat, there is a desalinisation plant, but it is yet in an experimental stage. In view of this, the potential for use of sea water for drinking purposes is limited.

Out of 5.76 lakh villages in the country, about 1.52 lakh are in problem areas, i.e. drought, backward and tribal. Of these, nearly 36,000 were expected to be provided with adequate water supply facilities during the Fourth Five Year Plan period. Under the Minimum Need Programme, Rs 573 crores are allocated for the Fifth Five Year Plan¹⁸.

Rural water supply schemes, however, require some initial cost, annual recurring charges and trained technical staff for day-to-day working. The work of providing safe water to rural people has not been taken as seriously as it should have been by Village Panchayats, maybe because they do not have sufficient funds or they lack understanding of public hygiene. Agencies like Gram Panchayats should educate the villagefolk to use water carefully and judiciously.

Several States in the country have undertaken the groundwater investigations. UNICEF has made available to them air hammer rigs and accessories for the purpose. However, the problem lies not only in tapping the groundwater resources, but also in providing the necessary power for the pumps to be installed. On the other hand, the frequent breakdown of hand-pumps, the high cost of their maintenance and their limited use as regards the capacity to lift water from a great depth, are some of the obstacles to their extensive use.

A proper estimate of population growth with reference to areas and periods is needed to be done in advance. Simultaneously, the backlog of making an adequate provision of drinking water both to rural people and rural livestock is to be cleared fast. This would further ease the problem. Some of the important steps which must be taken immediately in this context are: (i) to locate reliable sources of water of adequate quality and quantity and installation of pumps, both power-and-hand-driven; (ii) to make provision for storage of water, through constructing small dams, bunding etc; (iii) to design water supply schemes so as to minimise losses, and any possible contamination; (iv) to conserve water by various means and to maintain water supply systems; (v) to make a separate provision for livestock water needs; (vi) to explore the possibilities of developing groundwater resources, more so for dry areas; (vii) to educate people to discard

caste and religious taboos and other social restrictions in making use of water from any source. In stating the objectives of water supply in rural areas, the National Building Organisation has suggested that it should be (1) safe and wholesome; (2) adequate, (3) readily available to the users in order to encourage personal and household hygiene¹⁹.

References :

1. Qanungo K.R., *Sher Shah, A Critical Study Based on Original Sources*, Chapter 12, Kar Majumudar & Co., Calcutta, 1921 p-390.
2. *The Lectures Delivered by Sriman Maharaja Sayajirao Gaikwad*, part 1, (in Marathi) published by Damodar & Co., Bombay, 1936 p-1.
3. Hirshleifer J., De Haven J.C. and Millman J.W., *Water Supply Economic Technology and Policy*, The University of Chicago Press, Chicago, 1969, p-9.
4. Naik S.S., *Water Supply Part I*, Chapter V, the Local Self Government Institute, Bombay, 1956, p-32.
5. Varshineya J.K. and Mathur O.N., *Hand Book on Rural Housing and Village Planning*, Chapter 12, National Building Organisation, Ministry of Works, Housing and Supply, New Delhi, 1968, p-73.
6. Public Health Circle, *Preliminary Project Report on Rural Water Supply Schemes of Gujarat State*, Government of Gujarat, Rajkot, 1965, p-12.
7. Modi I.K. and Bhatt D.B., *Status of Rural Water Supply in Gujarat State*, (unpublished paper) Panchayat and Health Department, Government of Gujarat, Gandhinagar, 1975, p-8.
8. *Economic Review of Himachal Pradesh*, Part 1, Government of Himachal Pradesh, Simla, 1975, p-44.
9. Tamil Nadu—*An Economic Appraisal*, Part 1—Review, Finance Department, Government of Tamil Nadu, Madras, 1973, P-81.
10. Planning Commission, *Draft Fifth Five Year Plan 1974-79*, Vol. II, Chapter 11, Government of India, New Delhi, 1973, p-264.
11. Varshineya J.K. and Mathur O.N., 1968, *Ibid.*, p-74.
12. Naik S.S., 1956, *Ibid.*, Chapter VII, p-48.
13. Planning Commission, 1973, *Ibid.*, Chapter 10, p-1236.
14. Naik S.S., 1956, *Ibid.*, Chapter IV, p-27.
15. Linsley R.K. and Franzini J.B., *Water Resources Engineering*, Chapter 15, McGraw Hill, New York, 1964, p-424.
16. Public Health Circle, 1965, *Ibid.*, p-18.
17. Naik S.S., *Elements of Municipal Engineering*, Part IV, Chapter IV, The Local Self Government Institute, Bombay, 1957, p-9.
18. Planning Commission, 1973, *Ibid.*, Chapter 11, p-264.
19. Varshineya J.K. and Mathur O.N., 1968, *Ibid.*, Chapter 12, P-73.

Urban water supply in Tamil Nadu

By K. Govinda Menon

ALTHOUGH our country has plenty of resources, it is still poor. One of the recommendations made in the seminar on 'Financing and Management of Water Supply and Sewerage Works' convened by the Ministry of Health, Government of India, with the assistance of the World Health Organisation at New Delhi in April 1964 was the formation of water supply and drainage boards in every State for increasing the efficiency of financing and operation of municipal water supply and sewerage services. The recommendations made in the above seminar have been and are being implemented so far as Tamil Nadu is concerned. It is obvious that to achieve the objective of extending the two basic amenities to all the towns and the villages in the State within the shortest possible time, it is necessary that effective planning and execution of drinking water and drainage schemes are brought under the control of a single agency, which will be conducive to speedier planning, investigation and execution of schemes. This will also enable the agency to raise substantial resources from financing institutions and in the open market. With this object in view, the State government of Tamil Nadu constituted the Tamil Nadu water supply and drainage board as an autonomous body on a statutory footing, and the board came into existence in April 1971. The board took over the duties and responsibilities of the public health engineering and municipal works department, the erstwhile wing of the Government.

Priority list

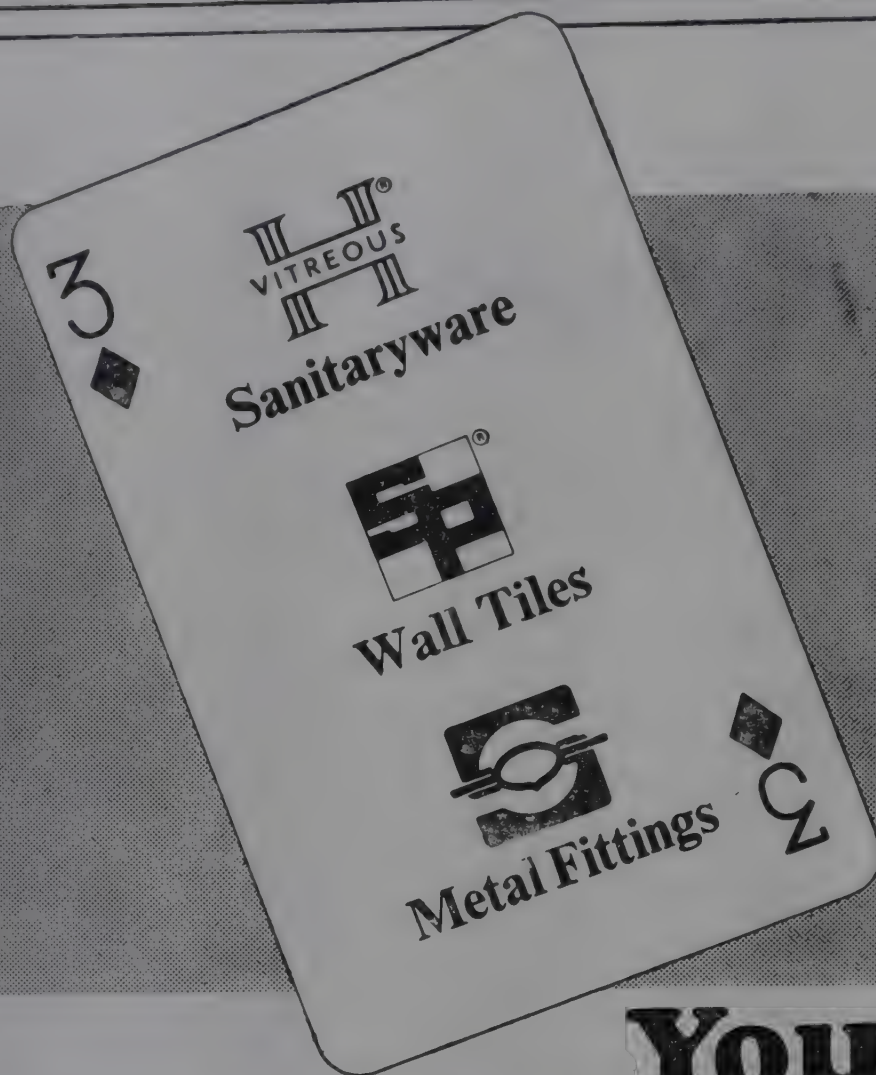
Functions of the board and its organisational set-up: The task of

providing the two inevitable inter-dependent basic amenities viz., potable piped water supply and efficient system of waste water disposal for the protection and promotion of public health in the State of Tamil Nadu is now vested with the Tamil Nadu water supply and drainage board. The functions of the board are to (1) investigate, plan and execute water supply and sewerage facilities in the whole of Tamil Nadu (2) provide assistance to the local bodies in the execution and maintenance of schemes and (3) carry out research and development work in the field.

The Tamil Nadu water supply and drainage board comprises an official or non-official chairman, six official directors including the managing director and technical director and three non-official directors. The chairman and directors of the board are appointed by the government. Its officers and servants too, are appointed by the board. The principal officers of the board are the chief engineer, Tamil Nadu water supply and drainage board in charge of urban water supply and sewerage works and rural water supply schemes, the special chief engineer, in charge of the Veeranam project to augment the Madras City water supply, the financial adviser and chief accounts officer and the secretary.

Urban population statistics: In Tamil Nadu, which has an extent of 130,000 sq km, there are two Corporation cities, 93 municipalities, 8 municipal townships, 13 Panchayat townships and 624 town panchayats (with population over 5,000). The total population of these 740 towns is 15.5 million as per 1971 census figures, which

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constitutes about 35 per cent of the entire population of 45 million of the State. The rate of increase in population (linear growth) is 2.23 per cent per annum. The density of population is 317 persons per sq km.

History of urban water supply schemes in the State: In Tamil Nadu, water supply schemes were initiated about a hundred years ago. The first two water supply schemes taken up in Tamil Nadu were in Madras and in Ootacamund both completed almost at about the same time in 1874. Subsequently by the year 1900, water supply schemes were provided in four more towns and by 1947 water supply was available in 47 towns in the State.

Soon after independence a water supply and drainage committee known as the Kaleswara Rao committee was set up in the State to go into the problem of water supply and drainage. This committee, *inter alia*, formulated a priority list for the provision of water supply to the towns in the State based on their endemicity, scarcity of drinking water, population, religious and commercial importance of the towns etc. Since then, during the successive five year Plan periods works on water supply were carried out based broadly on the priority list drawn up by the committee.

A major constraint in the fast provision of water supply schemes in Tamil Nadu has been the poor water resources position in the State. The average rainfall in the State is about 100 cm only. There are only a few perennial rivers in the State. Moreover, in the case of most of the rivers irrigation rights have developed to a very great extent leaving very little water to be tapped for public water supply.

Purification

Tamil Nadu is not very rich in groundwater resources either. Deep aquifers which can yield potable water in substantial quantities for urban water supply are found only in the alluvial tracts near the coastal belt and that, too, only in isolated pockets. Most of the inland areas constituting 70 per cent of the area of the State are of hardrock sub-stratum which is capable of yielding only limited quantities of water.

The poor water resources of the State have necessitated tapping distant sources for many water works. Impounded sources have been adopted where surface flows in the rivers are seasonal. In the case of perennial rivers with sandy beds like the Cauvery and the Tambiraparani the practice in the State has been to tap the infiltrated surface water by means of infiltration

wells and galleries. This has resulted in avoiding the need for costly treatment works which would be required with surface water. The majority of the rivers in the State have only seasonal flows, but many have sandy beds of 5 metres to 10 metres depth where a considerable quantity of water gets stored. Such sub-surface water has also been tapped in large measure for water supply by means of infiltration works. One major example of this is the Palar river in the northern part of the State which supplies water to 20 local bodies and other beneficiaries from its underground storage.

The quality of water in the State has been fairly satisfactory. In regard to the purification of water, no treatment except chlorination is being provided for surface water where the sources are sanitarily safe namely where the catchment areas are protected or are under reserve forests. Sub-surface water supplies are also only being chlorinated. The first treatment plant in the State had slow sand filters installed during 1914. The recent practice in the State has been to provide rapid gravity filters of conventional designs.

Present position

At present, water supply schemes are in operation in both the Corporation cities, 83 municipalities, 5 municipal townships, 8 Panchayat townships and 90 town Panchayats. Water supply schemes costing Rs 50 crores are currently in execution in about 140 towns. These schemes cover both new as well as improvement schemes. Investigations for providing water supply schemes are in progress in about 250 towns. About 70 per cent of the urban population has been covered by water supply. In respect of sewerage schemes, sewerage facilities are now available in 12 towns. Sewerage schemes are under execution in 10 towns. In about 50 towns investigations for providing sewerage facilities are in progress.

Financing: The outlay fixed by the working group of the Planning Commission under the water supply and sanitation sector for Tamil Nadu for urban areas other than Madras City during the Fifth Five Year Plan period is Rs 25.50 crores only; of this, Rs 21 crores is for water supply schemes, and Rs 4.5 crores is for sewerage schemes. Considering the magnitude of the work load involved in providing water supply and sewerage facilities for the remaining population in the State, the allotment earmarked by the Planning Commission is quite insufficient and is to be increased considerably. Moreover, in the Fifth Five Year Plan no provi-

sion is made for any new sewerage scheme. Even the provision made for the spill-over sewerage schemes is insufficient and hence it is considered necessary that the allotment made for drainage schemes should be increased so that from the public health point of view every town provided with water supply scheme can be covered by sewerage facilities also. Hence action has to be taken to mobilise resources from financial institutions like the Life Insurance Corporation of India and banks for which the Central Government should render necessary assistance.

The policy of the Tamil Nadu State government in the case of water supply schemes for urban areas is that the schemes should be financed by local bodies themselves. No grant is given by the government towards capital cost. The local bodies keen on having a water supply scheme are expected to collect water supply and drainage tax as a percentage on the property tax and the funds accumulated are to be used for meeting the capital cost. These accumulations are usually found to be a fraction of the cost of the scheme. Hence loans are advanced to the local bodies after assessing their financial capacities, for repaying the loan in easy instalments.

With the meagre finance made available during the three Plan periods only a few schemes could be taken up for execution. Since 1969-70 the LIC has been extending loan assistance to the board for executing water supply and sewerage schemes, so much so that many of the schemes could be completed more quickly and also a larger number of schemes could be taken up for execution. Thus, it is clear that the overriding factor that decides the pace of execution of schemes is finance. However, it is not advisable to depend entirely upon only one institution viz. the LIC. If the water supply and sewerage schemes are to be implemented as programmed it may be necessary to approach other financial institutions like the World Bank, IDA etc and to float loans. In this connection, I should like to make a suggestion. In our country there is a lot of money lying idle with many of the big temples, churches and mosques. It will be better if the accumulated funds are used for the provision of the basic amenities to the people of the town as well as to the floating population who come to have 'darshan' of the presiding deities. The money thus made available may be paid back to the religious institutions by the local bodies in easy instalments at normal rates of interest. A well operated water supply and sewerage

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scheme in the town will certainly avoid a huge recurring expenditure incurred annually for providing these basic amenities to the people during the festivals besides eliminating the epidemics that usually break out at times of the congregations causing considerable calamity. A pilgrim tax may also be levied, and the accumulations thus collected may be utilised for the execution of the schemes.

Management: An adequate and well maintained water supply scheme can result only from farsighted planning, sound engineering and constant vigilance. Any undertaking, despite its being economical and efficient, will end up in failure if it is badly managed. Wise management starts with a thorough knowledge of the system. An effective water management not only provides an improved and equitable supply to the public but also helps to reduce the running cost of the schemes. A good management would ensure a safe, dependable and adequate water supply and also an efficient operation of the water services as a viable commercial unit. Any interruption in the supply not only causes hardship to the public but also exposes them to serious health hazards. The quality of water should also conform to the public health standards at all times.

Proper financial management is necessary to ensure water supply. A water utility should receive a gross revenue sufficient to enable it to provide adequate service, to maintain the system, to pay the taxes required to earn a reasonable return and to secure financial status necessary to obtain money at reasonable interest rates for expansion of the system. Equipment maintenance is one of the keys to an efficient operation of a water utility wherein continuity of service is of prime importance. Good maintenance is good management. Effective maintenance ensures long life of the plant, low maintenance cost and better quality control. Preventive maintenance designed to eliminate breakdown repairs should be aimed at. Water management, besides improving the supply to the people, will reduce the running cost of the schemes considerably, and this in turn will help to run the scheme on a commercial basis. For effective maintenance there should be an adequate staff to exercise efficient supervision.

In this connection, it is to be mentioned that water management cannot be effected successfully if the public do not co-operate. The citizens should realise that a lot of expenditure has

been incurred to provide and maintain the water supply in the town; and that water costs money, and that just like any other commodity water, too, has a price tag on it. It is a crime to waste potable water. Hence there is need for educating the public about the necessity of conserving and making proper use of potable water. Such a sense could be inculcated in the minds of the people, only when the supply is metered like electricity. To run a scheme on a self-supporting basis it is imperative that the water supply is charged for, according to actual consumption.

The Tamil Nadu water supply and drainage board, while recommending water supply schemes for obtaining administrative sanction of the government, gives due consideration to the financial viability of the local body. The cost of water works out to Rs 1.50 to Rs 2 per 1,000 gallons on an average for domestic consumption taking into account the annuity to be paid and the maintenance charges to be incurred. After the schemes are completed these are normally handed over to the local bodies for maintenance. In cases where there are more than one beneficiary involved and in the case of government schemes and for schemes involving supply to industries, the maintenance is looked after by the board direct.

At present the supply of protected water is effected under two systems viz., (1) tap rate system and (2) metered system. Under the tap rate system, supply is charged at a fixed rate per tap per month which usually varies from Rs 5 to Rs 12 per tap per month. Under the metered system the supply is charged for the actual quantity of water consumed as per the meter readings. The metered rates vary from 30 to 45 paise per 1,000 litres. The supply is given for both domestic and non-domestic purposes. The non-domestic supply is normally charged at double the rate for domestic supply and is metered in all cases.

Water supply connections are given to the applicants by the local body through the licensed plumbers registered with the local body, after the remittance of the prescribed fees by the applicants. The flow of water to water supply connections is controlled by ferrules of sizes ranging from 10 mm to 40 mm according to the requirements of the applicant and as decided by the local body.

For effecting water supply as narrated above, detailed water supply by-laws are framed by the local body concerned and approved by the con-

cerned superintending engineer, Tamil Nadu water supply and drainage board under whose jurisdiction the local bodies lie.

Perspective plan

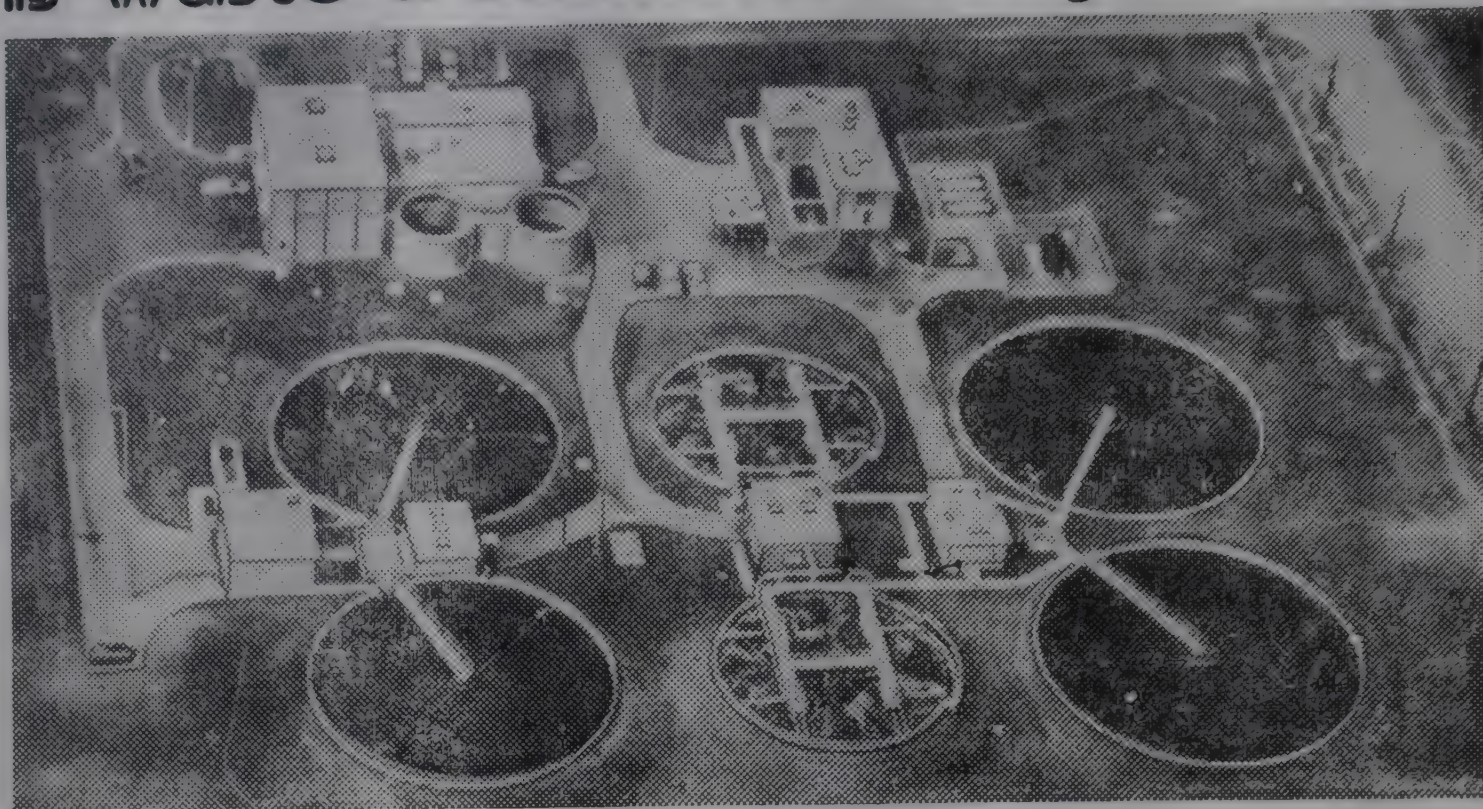
It is the broad policy of the Tamil Nadu State government and the main objective of the Tamil Nadu water supply and drainage board to provide drinking water facilities to the urban and rural population of the State in the shortest possible time. The board has an efficient machinery comprising fully qualified and capable technical personnel all over the State. It has developed expertise in the investigation, design and execution of water supply schemes. Some of the major projects under execution in the State by the water supply and drainage board are the Veeranam project for augmenting Madras city water supply by 40 mgd and the Siruvani water supply scheme for augmenting the water supply to Coimbatore. The 20 mgd water supply for the Tuticorin industrial complex has been recently completed. Proposals are under examination for providing water supply to the Salem steel plant.

In addition to the 20 mgd water supply scheme referred to above, the board supplies water to the Tuticorin Harbour Project, the steel casting plant, Arkonam, the small arms project, Tiruchirapalli and the heavy vehicles factory, Avadi.

A 12-year perspective plan has been prepared under the guidance of the chairman of the water supply board and submitted to the Planning Commission. This report contemplates provision of water supply to all the towns and villages in the State within the VI Five Year Plan period. The slow progress in the implementation of the schemes may be mainly attributed to financial stringency. The local bodies will have to improve their finances at least to the level of repaying the loan taken for the execution of the schemes and to run the schemes on a commercial basis.

The water supply and drainage board is fully alive to the magnitude of the problem of water supply in the State. With adequate finance made available, water supply and sewerage schemes could be pushed through and brought into use by the public with the minimum delay. The board is confident of fulfilling its responsibility towards the people of Tamil Nadu in the matter of provision of protected drinking water supply and sewerage facilities which are the basic amenities for the health and wealth of a community in the shortest period.

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WATER has become a problem of great concern. If there is inadequate water, scarcity conditions develop. If there is too much water, floods are the result. The demand for water for agriculture is increasing day by day because of the higher production needed. Water conservation should command more attention in our planning today, as never before has it become a limiting factor in agricultural production.

We are getting water for agricultural purposes from (1) natural precipitation, (2) underground resources, and (3) rivers and dams. Rain water either enters the soil or there is run-off at the surface. Whether the rain water enters the soil or there is run-off depends upon the intensity of rainfall, slope of the land, vegetation and the type of the soil.

It is extremely significant that conservation and management of water resources should start from agricultural land as it is here that most of the water falls before it goes down to the streams.

We can conserve water by increasing infiltration by using farm yard manure, crop rotations and by the run-off control measures. There is however little work done on run-off agriculture or water harvesting work for increasing agricultural production. In arid areas of the country where rainfall is very limited, this type of programme will have great significance. Even if the rainfall is say 12 inches and only 25 per cent of its run-off is collected and the catchment area is five times, effective rainfall will be 25 inches ($12 \times 0.25 \times 5 = 15$) as additional 15 inches will be available. There are always torrential rains during the cropping season when such run-off takes place. It is thus possible to use this water for agriculture purpose which otherwise would have been lost.

In Ahmedabad, the water table is receding at the rate of nearly 3 mts per year. The aquifers now largely tapped are below 100 mts. In north Gujarat, Mehsana is the district where there is considerable expansion of the tubewell irrigation. There are nearly 1,750 tubewells, and the water table is now at 40 mts against 25 mts 10 years back. As there is no control over the ground water, the water lift is so high that the water table is falling at the rate of 1.5 mts per year.

Mr Pathak is Director of Agriculture, Gujarat.

Efficient use of water in agriculture

By R. L. Pathak

Different artificial recharge proposals are being considered as the drawal is far more than the recharge. As an example, for the Vijapur area near the river Sabarmati water spreading by lifting excess water from the river as well as directly irrigating the area from the Dharoi dam which is under construction is under consideration. A United Nations Development Programme team is working on the details of the project.

It is, however, not necessary to always think of major schemes for recharging. At the Lok Bharati Institute at Sanosara in the Saurashtra area of Gujarat, it has been possible by diverting water from the rivulets and impounding them into artificial farm ponds to revive the water table in nearly 35 wells to their original level of 20 years ago. Not only the kharif crop is insured as supplemental irrigation will be possible if needed but rabi cultivation is also assured as the water table has risen. Similarly, in areas where sub-soil water is saline and which remain waterlogged during kharif, sweet water can be impounded into farm ponds and can be used for partial irrigation. As high as 40 per cent higher yield has been reported from such areas. It will thus be seen that, instead of considering bigger schemes for irrigating areas, if such smaller works are undertaken, which can be carried out at many places, the economic return will be much more as whatever rain that falls will be conserved in the fields and excessive run-off impounded in such ponds.

Work done on construction of farm ponds during the last two years in Gujarat, numbering more than 7,000, has established their utility. Farmers

have used water from the farm ponds for their supplemental irrigation. Crop yields have been higher than in the adjoining areas where such facilities were not available and the water table in the surrounding wells has risen.

Underground water

Underground water is perhaps the largest storage reservoir of water, more than big irrigation dams taken all together. In practice also the area irrigated by wells and tubewells is much more than by dams.

There are different groundwater problems in different areas. The recent development of irrigated agriculture is largely due to groundwater development mainly financed through the land development banks. There are signs that the water table is declining. Many wells are drying up every year in arid and semi-arid areas. This is because the rate of replenishment is inadequate to meet the recharge demand. There are now serious problems where water is pumped out faster than groundwater resources. In coastal areas, it has been found that pumping is so fast that the saline water is entering the aquifers making soil unsuitable for irrigation.

The corrective measures are prohibition of further developments, reduction in withdrawal, preservation of water and artificial groundwater recharging by allowing flood water to streams.

Groundwater is always available when it is required by the crop. The operator has control over its management but it is expensive because of

the lift. It is a common practice followed by advanced farmers to have underground pipelines for the control of seepage losses. In addition, the land needs to be shaped and levelled for efficient water management.

It is therefore a wise policy to conserve water where it falls for recharge as groundwater rather than to impound run-off water in big reservoirs. The groundwater is at the door of the farmer, the evaporation losses are nil and the losses during conveyance can very easily be controlled. The farmer can use the water at his will and the cost of development of tubewells or dug wells is comparatively less than big irrigation projects.

Interestingly, groundwater development in the private sector has come up very well and water from the dug well or tubewell is being utilised very efficiently. There are, however, government tubewells, the management of which has presented certain problems. Some of the States are setting up groundwater resources development corporations for development and management of such tubewells in an efficient manner. Exploratory work should continue in this direction.

Surface irrigation

Though we are constructing new major and medium irrigation projects, the underutilisation of the present ones is a problem of great concern to all the State Governments. It will be worthwhile to study the typical case of Mahi-Kadana project in Gujarat where the situation is similar to other irrigation projects in India.

The weir of the river Mahi was completed in 1959 and, though distribution system of canals was completed, utilisation was very poor even in 1969 i.e., after ten years of the completion of the project. When agricultural support programme was put into operation with the assistance of the World Bank, the main bottleneck for the proper utilisation of available water was the construction of water courses that would take water on to the fields of the farmers. It will be thus seen that even after constructing a dam or a weir the water resource developed remains unutilised for a considerably long period if there is no connecting system upto the farm.

It is further observed that, though individually all the farmers need water from the canals, they do not carry out this work themselves for the entire outlet consisting of 40 to 60 hectares as there is no co-operation amongst them.

By taking advantage of the land improvement acts that are now enacted in most of the States, it has now become possible to carry out construction of field channels for the entire area even if a minority of the land owners object to such a programme.

It will thus be seen that proper attention has not been paid in the past to the on-farm developments such as construction of field channels, land levelling, drainage for conservation and utilization of irrigation water on major and other medium projects. The trend now is in the right direction to take a comprehensive view of taking irrigation water from the dam to the field.

Know your land

Before any irrigation is practised, it is necessary to have soil surveys of the area. The soils vary in their capacities of (1) holding moisture, (2) intake rate of water and permeability. If the drainage is good, water applied in excess will go down out of the root zone. If the permeability is poor, water logged conditions will develop.

In many irrigation projects, the soil surveys are of a very general nature and not confined to irrigation land classification. As curative measures are not adequately taken from the very beginning, almost in all the irrigation projects where the soils are heavy and impervious, waterlogged conditions develop which ultimately make the lands unproductive for agricultural purposes. Thus, against the gains of irrigation we have to set losses of land where adequate drainage facilities are not provided.

It is only now that we have learnt that adequate attention should be paid to drainage. In Mahi-Kadana project as also in the Chambal canal project, master plans have been drawn up for providing adequate drainage to the soils which are already saline and are likely to go out of cultivation if irrigation water is applied.

The physical condition of the surface soil is called soil "tilth." Soils in good tilth are those which are easy to work, take up water easily and are best suited for higher agricultural production. Soils in poor "tilth" are those which are heavy, difficult to work and penetrate and are inhabited by hard material.

Root development is very important for higher production and also determines the frequency of irrigation. As the crops differ in root characteristics, the need for specialised advice

to the farmers on how much to irrigate is quite obvious. Soil should, therefore be maintained at proper soil moisture level for optimum production. If efficient irrigation is practised, the wetted area will be around the root zone; over-irrigation, the water will go down below the root zone.

Irrigation methods

Farms differ in their characteristics and the crops that are grown. It is therefore, necessary to select suitable irrigation methods. The following three methods are generally followed: (1) flooding; (2) by furrow; and (3) sprinkler.

The flooding methods include basins, border strip, wild flooding and border ditch etc, looking to the lay of the land and crops to be grown. In this method sheet of water is allowed to stand till it is absorbed in the root zone. In field to field irrigation, particularly in the paddy growing areas, farmers use nearly nine inches of irrigation water against the requirement of four to five inches. This practice of overirrigation ultimately spoils the land.

In the case of furrow, water is applied in rows of plants. It runs in the furrow of the surface soil to allow moisture storage under the growing plants.

Recently, a sprinkler irrigation system has been developed using lightweight pipes of aluminium. Though it has many advantages, the limitations are the high initial cost, wind velocity and high temperature resulting in evaporation losses.

It has, however, been observed that the greatest water losses occur in conveyance upto the field.

The transit losses also depend upon the soil type. This loss in some important soil type is shown in Table 1:

Table 1 : Water loss by soil

Soil type	Transit loss (cusecs per M.S. Ft)
Heavy clay loam	4.0
Medium clay loam	6.5
Silty clay loam	9.5
Sandy loam	17.0
Porous gravelly	35.0

Transit losses occur more if there are weeds in the canal and the canal is on high bank, which will increase seepage losses. Loss of water can be reduced and it can be conserved and utilised for other areas if the canals are properly lined. The effect of lining of water losses is shown in Table 2



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Table 2 : Impact of lining on water losses

Irrigation system	Loss in per cent			Wastage in fields	Utilisation
	Canals	Distributaries	Water courses		
Entire system unlined	15	7	22	27	29
Only canals lined	4	7	25	30	34
Canals, distributaries lined	4	2	26	32	36
Entire system lined	4	2	6	42	46

In an experiment carried out for the losses in the water courses, following results were obtained:

Length of water course ..	1930 ft
Type of soil	Sandy soil
Losses I watering	II watering
36.8 per cent	36.22 per cent

In another experiment, 35 per cent losses were observed in an effective length of 500 metres. These experiments were for a period of three rotations. The losses in field channels where the soils are heavy will be about 20 per cent. Even if the saving is considered as 20 per cent, in a block of 60 acres additional area that will be brought will be 12 acres $\left(\frac{60 \times 20}{100}\right)$ if the channels

are lined. The consequent benefits can be summed up as follows:

- (1) Additional area that can be irrigated due to saving of water losses in a block of 60 acres 12 acres
- (2) Additional revenue Rs 33/acre for paddy (33x12) Rs 400
- (3) Additional food production on account of irrigation. 16.80 tonnes
1.40 ton/acre (12x1.46)
- (4) Cost of additional production at Rs 2/kg (1680x2) Rs 33,600
- (5) Net cost of food production Deduct 50 per cent charges for labour, seed, fertilizers, etc.
33,600 — 16,800 = Rs 16,800
- (6) Total revenue (2+5) Rs 17,200
Say Rs 17,000

The cost of lining a channel comes to Rs 600/acre as against Rs 100/acre

for earthen one. The additional cost will thus be Rs 30,000. The cost-benefit ratio comes to 11.33 and 5.66 at 5 per cent and 10 per cent interest respectively, which justifies the lining of the field channel.

We have therefore a choice whether we should go on developing more irrigation projects and block up funds or adopt better water management practices in the existing potential created so that there is efficient water utilization. If irrigation water is not properly conserved, wasteful water will only add to the problems of drainage and waterlogging, not only in the existing projects but in all others to come.

Agricultural support programme

The Government of India had set up a joint working group in the year 1963 to examine under-utilization of irrigation potential. It said: "The dry-land farmer accustomed to traditional methods of farming was not conversant with the nature of adjustments necessitated by the change of conditions brought about by the availability of irrigation water."

Similarly, a joint FAO—UNDP—GOI team had made the following observations: "The tract now irrigated has long been settled by farmers who depended entirely on the monsoon except for very small plots irrigated from wells. They had no other experience of irrigated farming and no instruction in water use and management has been given to them. Indeed it appears that no formal instruction in water management has been given to the extension

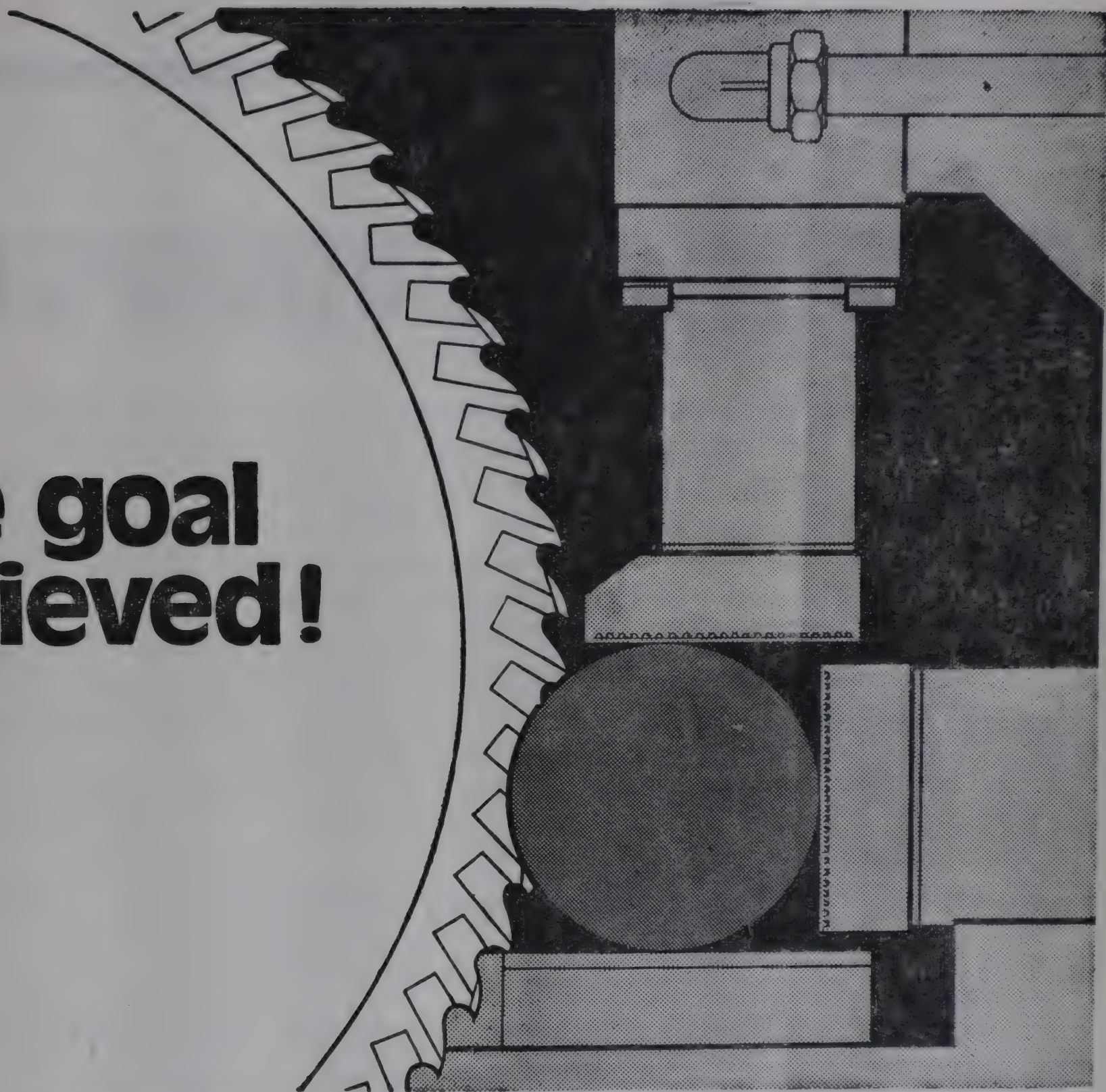
officers. Under these circumstances, the irrigation network that has emerged is primitive and unplanned, without adequate levelling and proper spacing between channels."

A farmer who gets irrigation water for his crop after waiting too long, does not wait to learn how best he can make use but he thinks that the more water higher the crop yields. Thus he wastes valuable water which can be used for additional crops. It is for this reason that trial cum-demonstration farms are set up in the irrigated areas for educating the cultivators in the methods of irrigated farming. These stations should provide information as to the crops to be grown, the manner in which water should be applied, how to overcome adverse soil as it creates drainage problems and proper fertiliser practices under irrigated conditions. The extension workers in the irrigated areas also need to be properly oriented for providing timely advice to the farmers. In the earlier irrigation projects emphasis was only on the construction of the dam, but there was no provision for the on-the-farm development programme. Now it has been decided by most of the States to take up such programmes which are known as agricultural support programmes. This programme will go a long way towards proper conservation and utilization of irrigation potential created.

Administration of water

Today, water is supplied by the project authorities. Often it is the experience that water is not made available to farmers when it is required. Since water is a scarce commodity and demand is seasonal, there are conflicts in its proper use at the field level. It is therefore, most desirable to have some local control over the management and use of water. It is only when such a system is developed that there will be maximum production from the available water. It has, therefore, been suggested water co-operatives should be set up, as is the practice in the USA, which can distribute water and fix irrigation rotations. It is high time something positive is done in this direction of local control for water conservation and its efficient utilisation at the grass-roots

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Choice of crops for dryland agriculture

By S. K. Sinha

A LARGE part of our country is entirely dependent upon rainfall for agriculture. Some people refer to this type of farming system as rainfed agriculture. In recent years, however, the terms dryland agriculture and dryland farming have also been commonly used. Indeed, the rainfed agriculture includes areas of high, medium and low precipitation. The dryland farming regions usually are characterised by an uncertain pattern of rainfall and moisture stress conditions during the crop growth period. This is not to suggest that the development of moisture stress is inevitable but only to point out that it does frequently occur. The term agriculture in semi-arid tropics is also in vogue. Thus, fine distinctions are made between different terms which provide excellent material for academic discussions and exercise.

Often the amount of total rainfall is used for classifying different farming systems. This, in fact, may be an inadequate parameter because the amount of total rainfall gives no clear indication of the amount of water available for crop growth. Nonetheless, it must be recognised that rain-water is the major source of crop production in India. At present, control over rainfall and its distribution are only remote possibilities. Therefore, the choice with us is to plan for the right kind of crop in relation to the rainfall pattern.

Figure 1 shows the average distribution of rainfall in different parts of the country. It is clear from this map that there are regions in the country which receive only 10 to 15 cm of rain annually. Most of the semi-arid regions receive on an average 25 cm to 60 cm of rain in a brief period of three to four months.

Under the All-India Co-ordinated Dryland Agriculture Project, the country has been divided into different moisture deficit zones based on annual precipitation and potential evapotranspiration. A large number of experiments, essentially agronomic in character, have been conducted to evaluate the performance of various crops and crop management practices in dryland regions. It is time now that some conclusions are drawn from these experiments on the choice of crops for different dryland regions.

Evaluation of needs of crops: The choice of crops and crop management depends upon the prevailing rainfall pattern of the region. We encountered the following situations:

(i) Rainfall only about 10-15 cm annually but can be good once in five years or so. These areas, in fact, fall in the category of arid zone.

(ii) Rainfall sufficient for one crop but rains start either late or earlier than the expected time.

(iii) Rainfall normal but there are intermittent periods of water deficiency, sufficiency and excess.

(iv) Rainfall if normal is more

than enough for one crop but insufficient for two crops.

(v) Rainfall insufficient.

These situations when combined with varying day length and temperatures create different agroclimatic conditions in different regions of the country. Therefore, the application of dryland agriculture technology becomes location specific.

Let us consider some of the situations individually and assess the requirements of different regions.

(1) When the rainfall is only about 10-15 cm annually and the chances of good rain are only once in five years, is it possible to depend upon normal cropping agriculture alone? Such areas are to be found in western Rajasthan and parts of Gujarat where potential evapotranspiration is also relatively high because of high temperatures and low relative humidity. Bajra, cowpea, mung etc have been grown

Table 1: Variation in grain yield of cowpea and mung in two seasons at different locations

Location	(Yield in g/ha)			
	Cowpea		Mung	
	Season I	Season II	Season I	Season II
Jodhpur ..	6.4	1.3	4.7	2.4
Bhubaneswar	1.97	2.88	7.46	4.61
Hyderabad	—	12.35	—	11.98
Ludhiana ..	—	18.5	—	—
Akola ..	3.87	5.84	—	—
Kovilpatti	9.43	16.05	—	6.40
Agra ..	4.12	7.56	5.50	7.75

Dr Sinha is Senior Plant Pathologist at the Water Technology Centre of the Indian Agricultural Research Institute.

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with success in these regions. However, by all standards the yields of these crops are relatively low. This is to be expected because of the short period of moisture sufficiency available for growth and development. If in such regions the water shortage becomes acute during grain filling period, the crop yields will be further reduced. Therefore, it is only once in five years that good grain yields can be expected.

In such regions the total economic development of the community has to be the ultimate aim rather than crop improvement alone. Accordingly, the avenues to improve the income of the

In addition, the low rainfall regions can be developed as grasslands. There are two advantages in doing so. In the first place, we have not to worry about the yield in the form of grains which is more easily influenced by adverse temperature and low moisture. Secondly, there are now a large number of known grasses which are called "tropical grasses". These grasses have higher rates of growth coupled with higher water use efficiency. When these grasses are grown as a mixture with some leguminous fodders, the fertiliser requirements of the grassland are also economised. In addition, the combination of grasses with legumi-

nous plants provides nutritionally better balanced fodder for animals.

It is not surprising, therefore, to find that people in these regions do have cattle and sheep as the main source of livelihood. This has come as a result of experience gained over centuries. The present efforts have been to augment and supplement this mode of profession with the available scientific information.

(2) When the rainfall is normally sufficient for one crop, one comes across a situation when rains start early or late. What are the crops which can be more suitable in such a situation?

Table 2 : Yield and water use efficiency

Crop	Yield q/ha.	Water use efficiency kq./mm/ha.
Wheat	5.64	4.8
Gram	9.14	7.9
Safflower	12.32	10.6
Linseed	5.28	3.6

people, independent of crop alone, have to be considered. In low precipitation regions some trees do grow and if we can make the right choice it can be helpful. For example, the *Accasia* species are relatively easier to plant and grown. Two economically important species are *Accasia senegal* and *A. seyal* which are important sources of gum arabica. About 90 per cent of gum arabica is now produced in Sudan and exported from that country where almost the same climate prevails. The international price of this commodity varies according to the harvest of gum in Sudan which is manually practised by poor people.

However, a shortage of the manual labour affects productivity. In India we grow *Accasia arabica*, *Prosopis juliflora* and *Prosopis indica* which can be easily and successfully replaced by *A. senegal* and *A. seyal*. This in due course can help increase the income of the region and the community will not have to depend upon good rains which are uncertain and erratic.

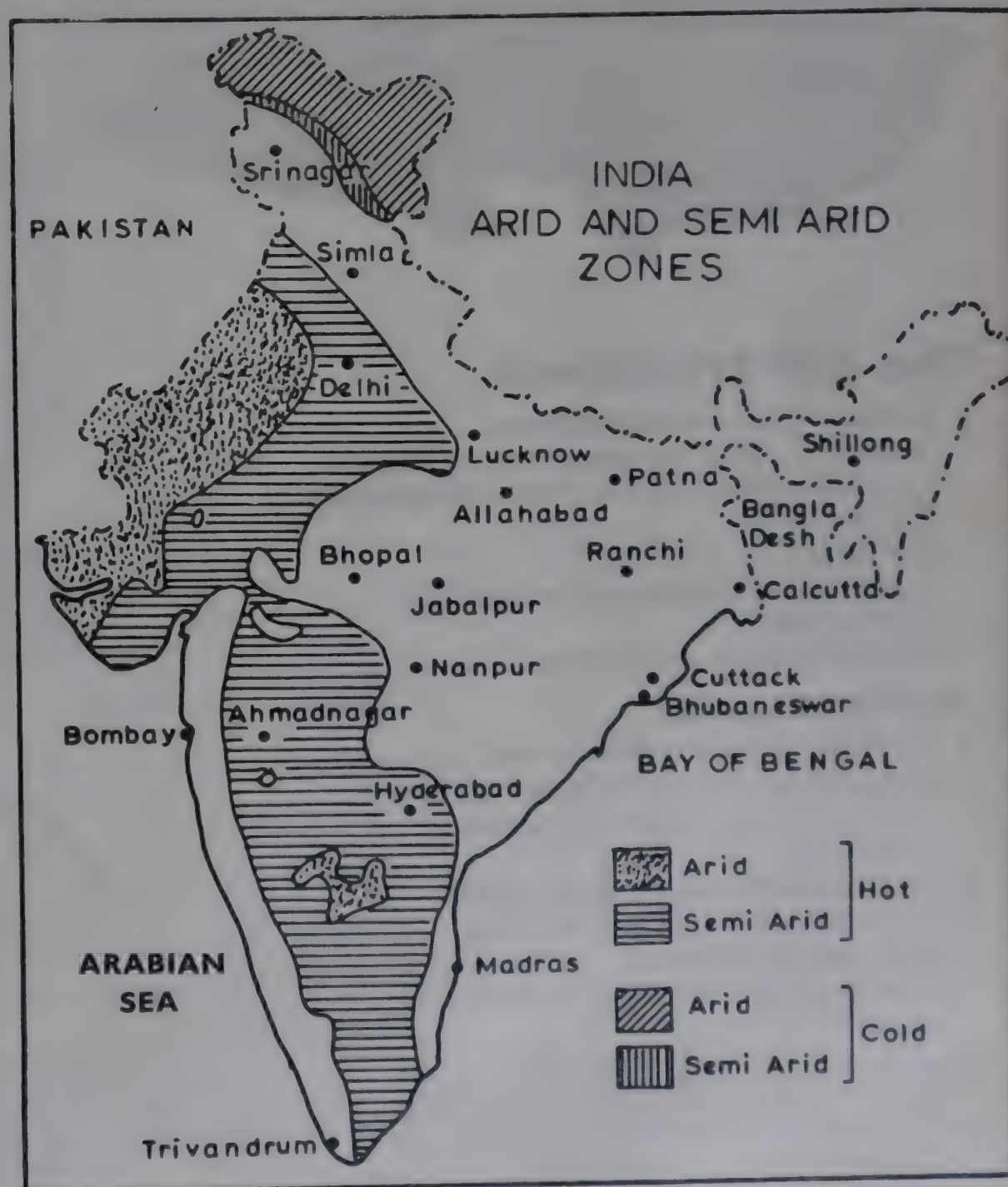
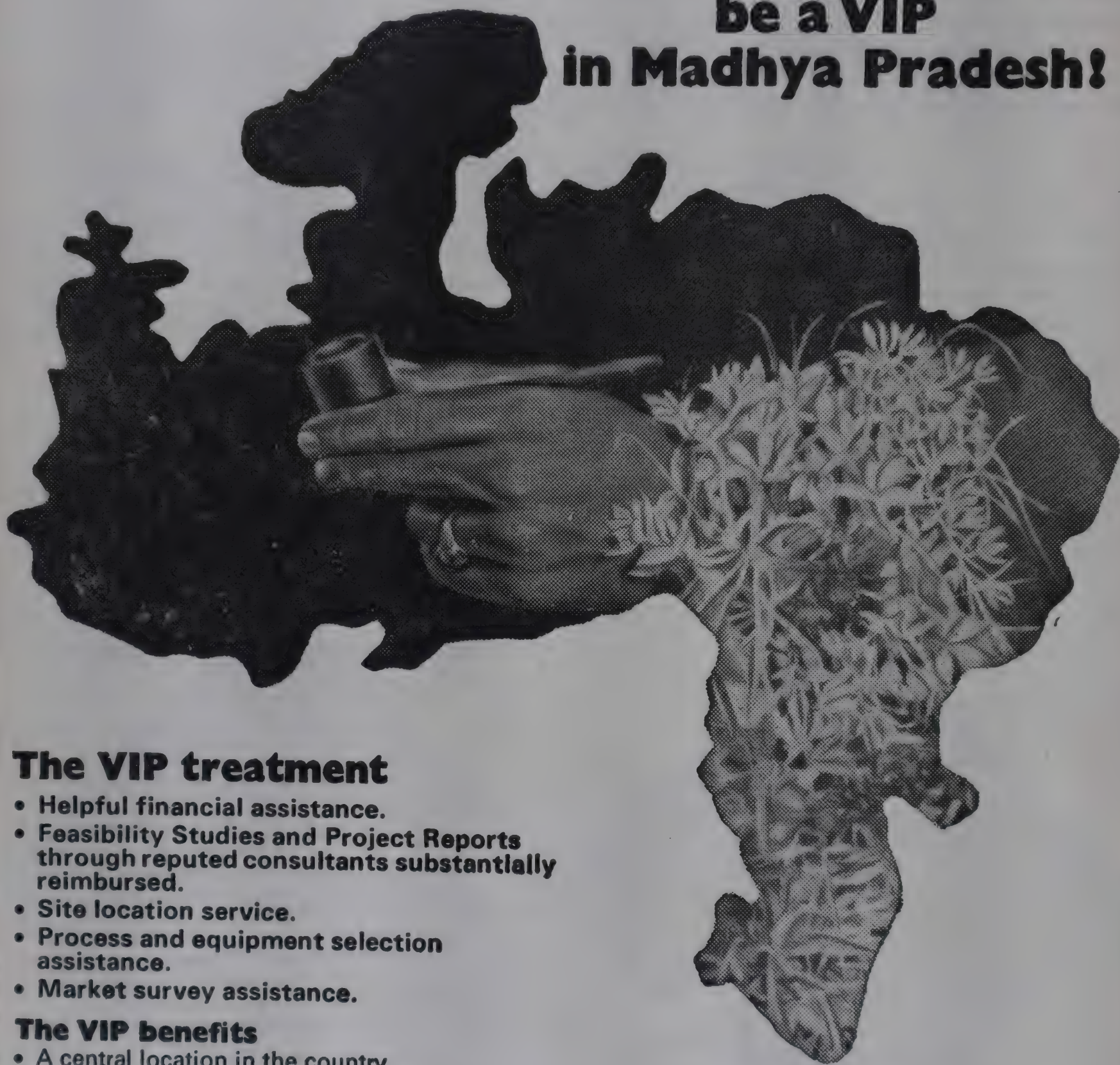


Fig. 1.

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Table 1 provides data at some locations obtained under the All-India Co-ordinated Dryland Agriculture Project. It would be seen from these data that yield of crops varied in the two years even when the same variety was used. The following factors influence yield at different locations:

(i) In South India there is relatively little change in temperature and day length. Therefore, the arrival of rain somewhat early or late does not materially affect crop productivity. In this region failure of normal rainfall would influence yield.

(ii) In central India there is little change in temperature upto October but the day length decreases to some extent. In this situation if the rains are early and adequate, good vegetative growth would be achieved before the reproductive phase of the plants sets in. Late rains delay sowing and cut short the vegetative period and accordingly the reproductive organs are reduced in number or size, thereby reducing yield. However, a drastic fall in yield will not occur unless rains are delayed by a month or more.

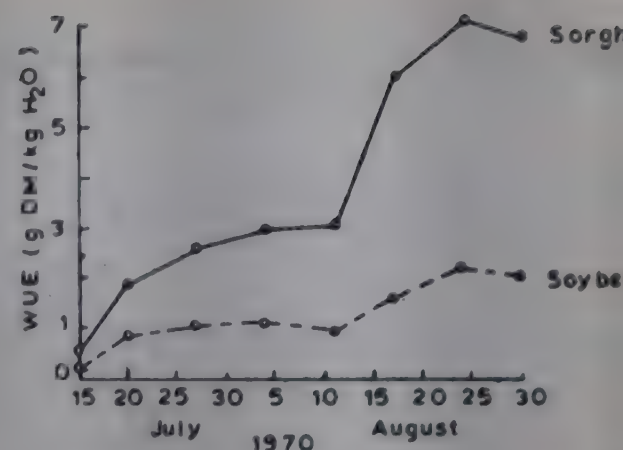
(iii) The influence of early or late rains is maximum in North India. If the rains arrive early by the end of June or the first week of July, the crops such as bajra and sorghum would grow well and also yield well. This is so because the grain development in these crops would be completed by the time low temperatures of October and November are experienced. These crops are the major kharif cereals and in these crops low temperatures adversely influence grain development and yield. Consequently, late arrival of rains, say by the end of July or early August, shifts the sowing time

and sorghum (jowar) and bajra grain development occur during late October and November. Relatively sub-optimal temperatures and low insolation cause poor yield of these crops. Therefore, once the rains are late, the farmer has two alternatives: To take a leguminous crop which usually is a short duration crop, or to convert the land for rabi cultivation, particularly for wheat.

At present both these practices are in vogue. However, a leguminous crop is usually characterised by low water use efficiency (WUE). This can be seen from the figure 2, where the water use efficiency of sorghum and soyabean was compared over a long period. Therefore, it appears that the cultivation of a leguminous crop may not necessarily give a full return in terms of water economy. In such a situation fodder sorghum and bajra should be evaluated.

(3) In several parts of the country where rainfall is around 40 cm or above we come across a situation where the available water is more than enough for one crop in kharif but is insufficient for two crops. What kind of crop combination will be useful if some amount of additional water is available for irrigation?

In kharif the common crops are bajra, sorghum, maize, arhar, cowpea, mung, soyabean and til. These crops have two different patterns of root system. In bajra, sorghum and maize the plants normally use water from the upper layer of the soil. Therefore, after the harvest of the crop some moisture may remain in lower layers that has not been utilised. As against this arhar, cowpea, mung, soyabean and til send their roots deeper than one metre and are likely to use moisture from all the zones. These crops, however, have poor water use efficiency and consequently would produce less using more water. Therefore, if one could take a crop of shallow rooted plants in kharif, moisture could be left for rabi for a deep rooted crop. In the latter case one pre-sowing irrigation could be enough for the establish-



Differences in water-use efficiency (WUE) of soybeans and sorghum throughout the season 1970

Fig. 2.

ment of crop if the late rains in October or November failed.

The main rabi crops for dryland are wheat, gram, safflower and linseed. In one of the experiments under the All-India Co-ordinated Project the results as shown in Table 2 were obtained on the yield and water use efficiency of these crops.

In this experiment safflower which is a deep rooted crop appeared to be the best choice. In other experiments it was observed that mustard and barley were also suitable. The potential of these crops to send their roots deep in soil is possibly an important factor for their better performance.

The second important thing is how quickly these roots are sent through. Again, crops like mustard and sunflower have an initially faster root growth (Table 3). Therefore, once they have germinated within a few days they establish contact with water in lower layers. Even if there is a dry spell and the upper layer of soil loses water, these plants would not suffer very much. But plants like wheat, sorghum and even bajra can suffer. Here, in fact, comes the question of revival after an initial setback. For example, if plants of wheat suffered initially, they would not revive but barley in winter and bajra in kharif would revive. The latter plants have some mechanism which makes the revival possible and, secondly, they develop very quickly a well developed and ramified root system to utilise the available water. Therefore, the choice of such crops becomes imperative.

Table 3 : Root length in one week old seedlings

Crop	Root length (cm)
Cowpea	11.3
Sorghum	8.3
Wheat	5.3



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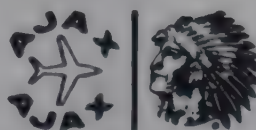
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Water for food production

By V. Lakshminarayana

SELF-SUFFICIENCY in food production is of vital importance to Indian economy. A large country like ours cannot afford substantial imports. At the most, the food import should be kept marginal. One of the prime requisites for increasing food production is water. Only when there is enough water, can we use other agricultural inputs like high yielding varieties, chemical fertilisers, etc.

Demand

Population pressure: All over the world demand for water has been growing steadily, mainly because of increase in population. In our country population has been growing at an enormous rate. At the beginning of this century, the population was 238.4 million. Today it is estimated to be 600 million. Figure 1 illustrates the growth of the population from 1901. The solid line shows the growth from 1901 to 1971. The broken line indicates the growth till 2000 A.D.¹

Assuming that the various family planning programmes undertaken will take some time to show results and that the general standard of living of the poorest 60 per cent of the population which lives below the poverty line will rise (which will have an effect on the size of the family) during the latter half of the period, it is estimated that the population will reach about 723 million in 1986. The expected growth rate during 1981-85 is 14.5 per thousand per annum. Assuming that this will be maintained during the subsequent 15 years, the population, in our country, is expected to reach 900 million in the year 2000 A.D.

Current food situation: Our diet is dominated by cereals and pulses. Among cereals, rice and wheat are preferred, and among pulses arhar (Tur) and gram. Approximately 74 per cent of the average total caloric intake is from foodgrains, with sugar,

vegetable oils, starchy roots, fruits and vegetables making up most of the remainder². The average quantity of caloric intake of an Indian can be calculated by knowing the foodgrains produced and imported and the level of population. Table 1 gives these values for the years from 1951 to 1974.

It is seen from the table that mean per capita availability between 1961 and 1974 was 163.9 kg/year. Using the figures given in reference (3) for calories per gram of foodgrain by type, the per capita availability of 163.9 kg/year corresponds roughly to 1550 calories per person per day. The requirement of calories and protein is dependent on sex and age. Using the body weights determined by the Indian Nutritional Research Laboratory, the

required daily energy intake is estimated to be 1955 calories per day and an average protein intake of 39 to 40 grams².

The averages, of course, are misleading. The poorer segments of the population receive considerably less nutrition than the average. Figure 2 shows a comparison of protein and caloric intake of several countries⁴.

Clearly, the position regarding energy and protein requirement and the current intake, though not alarming, is far from satisfactory. There are marked contrasts in consumption levels between economic groups in both rural and urban areas. To reduce this disparity and to provide a satisfactory diet for our growing population it is necessary to increase the agricultural pro-

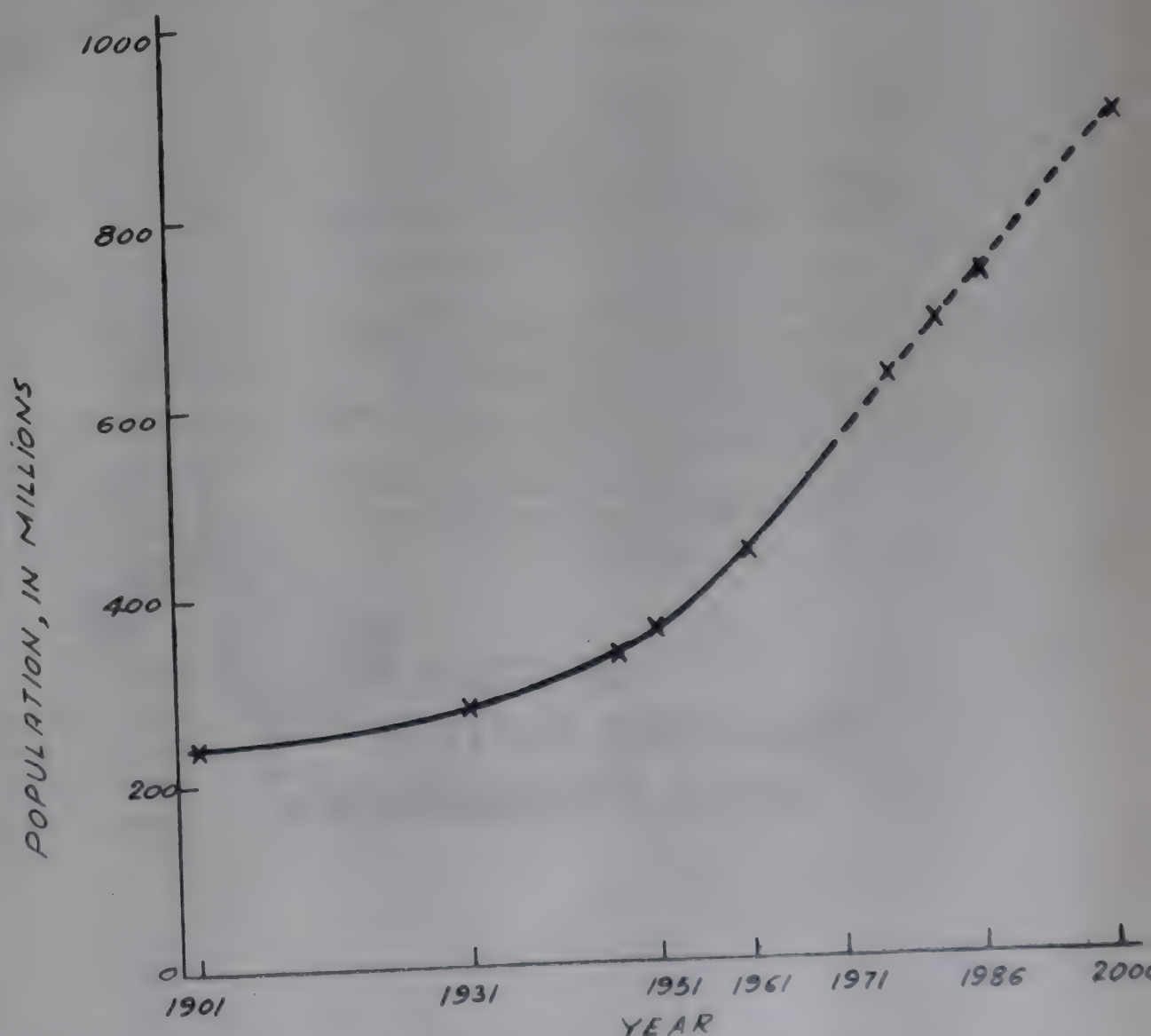
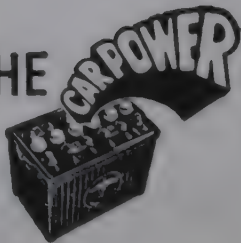


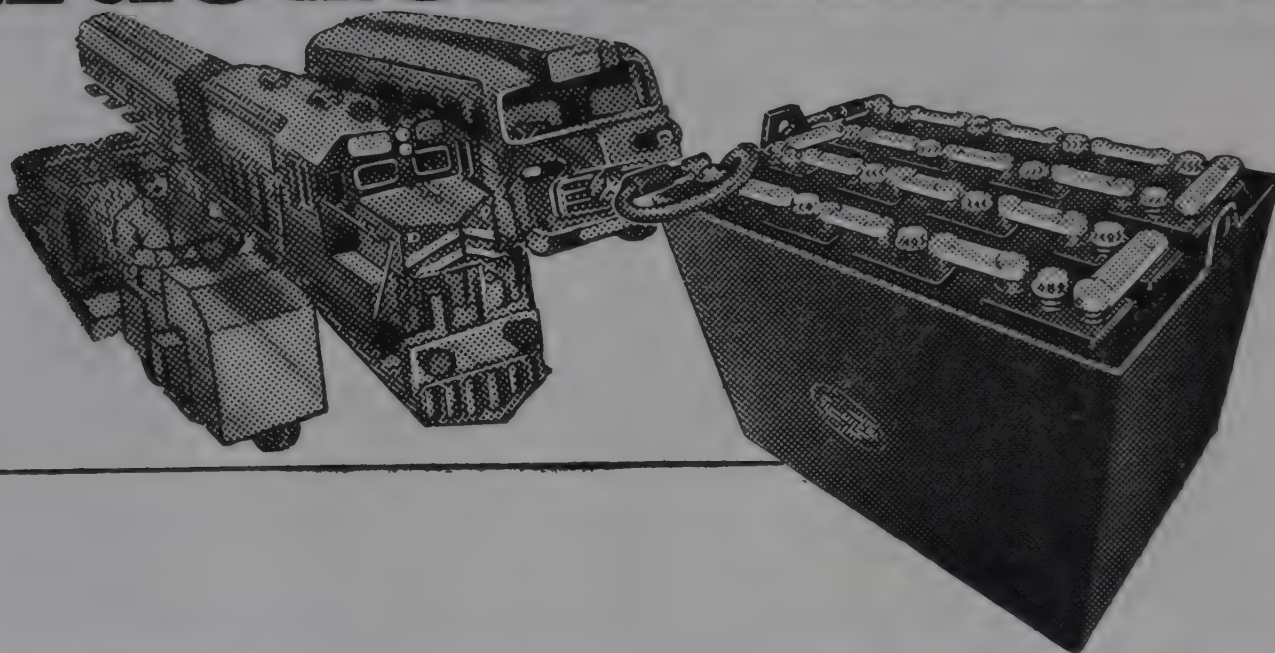
Fig. 1: Growth of population

Mr Lakshminarayana is Assistant Professor, Department of Civil Engineering, Indian Institute of Technology, Kanpur.

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duction. It is estimated that the total food and fibre needs of our population will be doubled in the next 25 years.

Supply

Land resources: The total geographical area of the country is 328 million hectares. Table 2 shows the land use statistics for the year 1967-68. There has been an increase, from 1951 to 1968 of 21.8 million hectares in the land under forests, a decrease of about 7.2 million hectares in fallow land including current fallows, and the increase in the area shown from 1961 to 1968 is small compared with that from 1951 to 1961. The Irrigation Commission¹ feels that the upper limit in respect of new land capable of being brought under plough is being approached.

Water resources: The principal water resources are the surface water and the ground water resources. There have been different estimates of surface water resources of the country. Dr A. N. Khosla⁵ has estimated the total annual flow in all the river systems in India (i.e. the total surface water resources) as 167.26×10^6 hectare metres, whereas the Central Water Commission (CWC) gives a figure of 188.11×10^6 ha.m. (A hectare metre is the quantity of water which covers an hectare to a depth of one metre. A hectare metre equals 10,000 cubic metres.) Figure (3) shows the 18 river basins into which the country (excluding the islands) can be divided.

Table 1 : Total foodgrain production, imports, changes in Government stocks, and net availability

Year	Production (x 10 ⁶ tons)		Net imports (x 10 ⁶ tons)	Stock changes (x 10 ⁶ tons)	Population (x 10 ⁶)	Net availability per capita (kg/year)
	Total	Pulses only				
1950-51	50.8	8.4	4.80	0.59	363.2	134.0
1955-56	66.9	11.0	1.44	-0.60	397.3	152.5
1960-61	82.0	12.7	3.50	-0.17	442.4	170.5
1964-65	89.4	12.4	7.46	1.06	482.5	175.4
1965-66	72.3	9.9	10.36	0.14	493.2	145.6
1966-67	74.2	8.3	8.67	-0.26	504.2	146.5
1967-68	95.1	12.1	5.70	2.04	515.4	168.6
1968-69	94.0	10.4	3.87	0.46	527.0	162.5
1969-70	99.5	11.7	3.63	1.12	538.9	166.2
1970-71	108.4	11.8	2.05	2.57	550.8	171.3
1971-72	105.2	11.1	-0.48	-4.69	502.5	172.8
1972-73	97.0	9.9	4.12	-0.66	576.7	153.1
1973-74	103.6	9.8	6.10	-1.70	589.7	167.0

SOURCE : India : A Perspective on Food Situation (see reference 2)

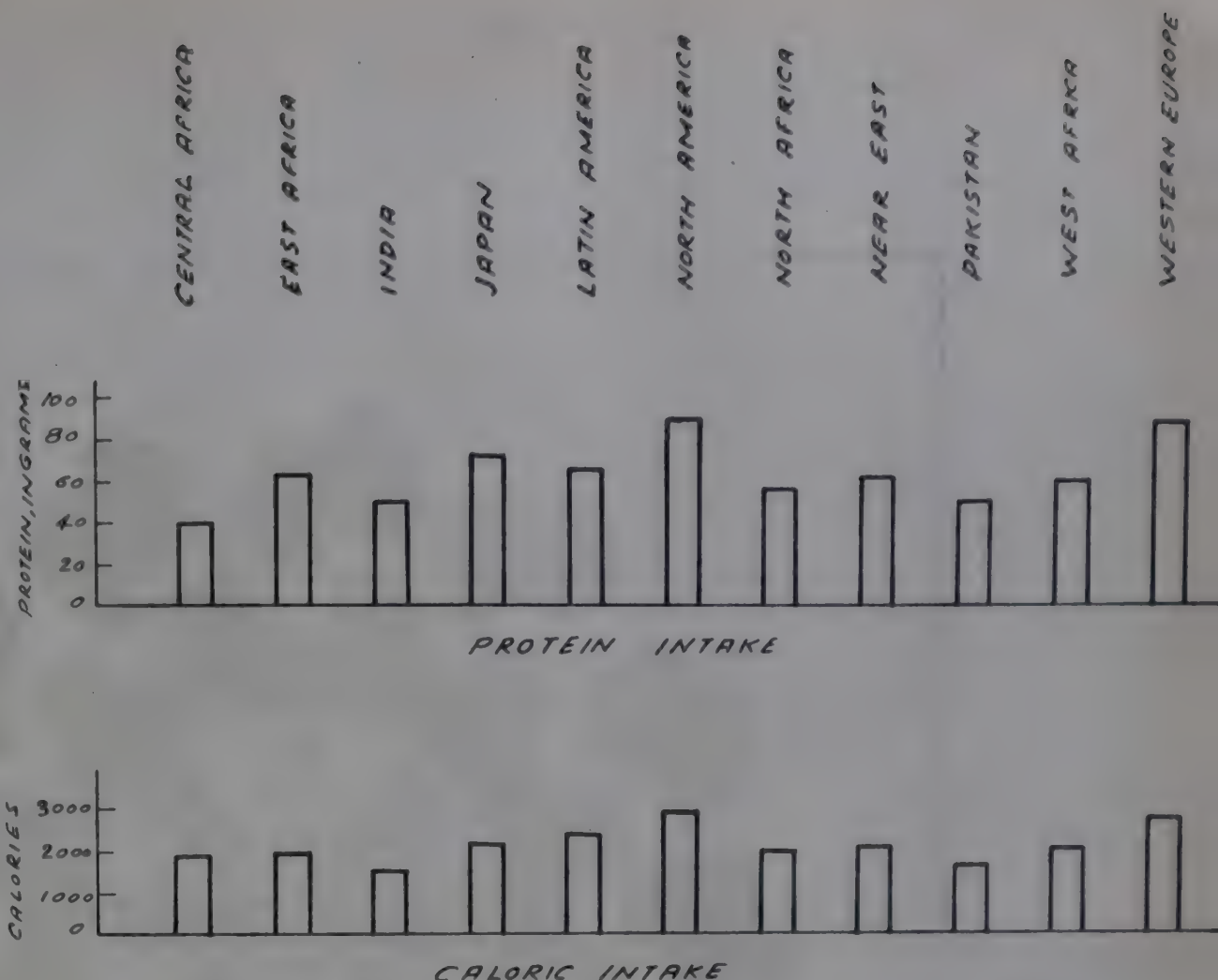


Fig. 2: Comparison of protein and caloric intake of several countries

Table 3 gives the estimated surface water resources in the rivers, zonewise, as given by CWC.

Not all this water can be utilised because of topography and limited opportunities available for storage. Table 4 gives the utilisable surface water resources as estimated by the

Irrigation Commission¹. However, it is possible to utilise more of monsoon waters than shown in the table by the technique explained later.

Estimation of ground water resources is difficult. For accurate assessment of ground water resources, detailed information regarding the

Table 2 : Land utilisation statistics

Classification	Area for the year 1967-68 (x 10 ⁶ hectares)
1. Total geographical area	328.048
2. Area under forest	62.323
3. Area not available for cultivation being barren, uncultivable, or put to non-agricultural uses	48.087
4. Other uncultivated land excluding fallow land, permanent pastures, land under tree crops and groves	34.561
5. Fallow land	20.833
6. Net sown area	139.702
7. Area for which no returns exist	22.542

SOURCE : Report of the Irrigation Commission



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- Decentralising industry to rural areas
- Instituting job-oriented educational system
- Upliftment of small farmers and farm workers
- Speeding up of afforestation
- Upliftment of Harijans, tribal and backward classes

The effort is on. And a lot more to be achieved before we could rest.

Every forward step counts DI 1/75

water bearing formations underground (aquifers) should be available. Water budget studies should then be made for different river basins and the aquifers associated with them to find the ground water potential. Raghava Rao, et.⁶ have attempted to assess the ground water resources on the basis of rainfall infiltration and contributions from seepage from canals, tanks, etc. The utilisable ground water resources given by them in 20.4×10^6 ha.m.

Thus the total utilisable water resources of the country is estimated to be 87×10^6 ha.m.

Irrigation potential: In 1951, the net irrigated area was 20.8×10^6 hectares, and the net irrigated area had become 27.5×10^6 hectares in 1968. With the current methods of practice of irrigation it seems that the available utilisable water resources, after allowing for estimated industrial and domestic demand, would be barely sufficient for doubling the area under irrigation in the next 25 years.

Can we decrease the demand? The question may also be put as: Can we increase efficiency? Decreasing the demand is one approach to adjusting the demand-supply position. Increasing the supply is another. Domestic demand is not likely to decrease. In fact the per capita domestic demand is likely to increase as the standard of living increases. But the quantity of water used in domestic supply is very small compared with that of industry and agriculture.

Both industry and agriculture, on the other hand, are concerned about reducing water use or increasing the efficiency of water used. Farmers, for example, use miles and miles of canals to convey water to growing plants. About two-thirds of the water let out at the head of the canal never reaches where it is required. It evaporates or seeps into the soil.

Table 3 : Surface water potential

River basin (Zone)	Water potential ($\times 10^6$ ha.m.)
1. West flowing rivers	30.56
2. East flowing rivers	35.57
3. Indus basin	7.96
4. Ganga basin	55.03
5. Brahmaputra and Barak basin ..	59.09
Total	188.21

SOURCE : Report of Irrigation Commission.



Fig. 3: River basins of India¹

Crops require certain amount of water for maturing. This water is called consumptive use. In providing irrigation to crops the aim should be to provide this consumptive use plus any additional quantity required for controlling salt-building.

Undoubtedly, the crops that use water most efficiently are those grown by hydroponics, or soil-less farming. More of a scientific curiosity than a threat to present practices, it is practised mainly in regions where topsoil and rainfall are scarce and food must be imported at great expense. Through hydroponics, almost any plant, from tomatoes to wheat, can be grown. Only water lost through evaporation and plant transpiration must be replaced, since all the required water is furnished by a recirculating stream to which proper chemical nutrients have been added⁷.

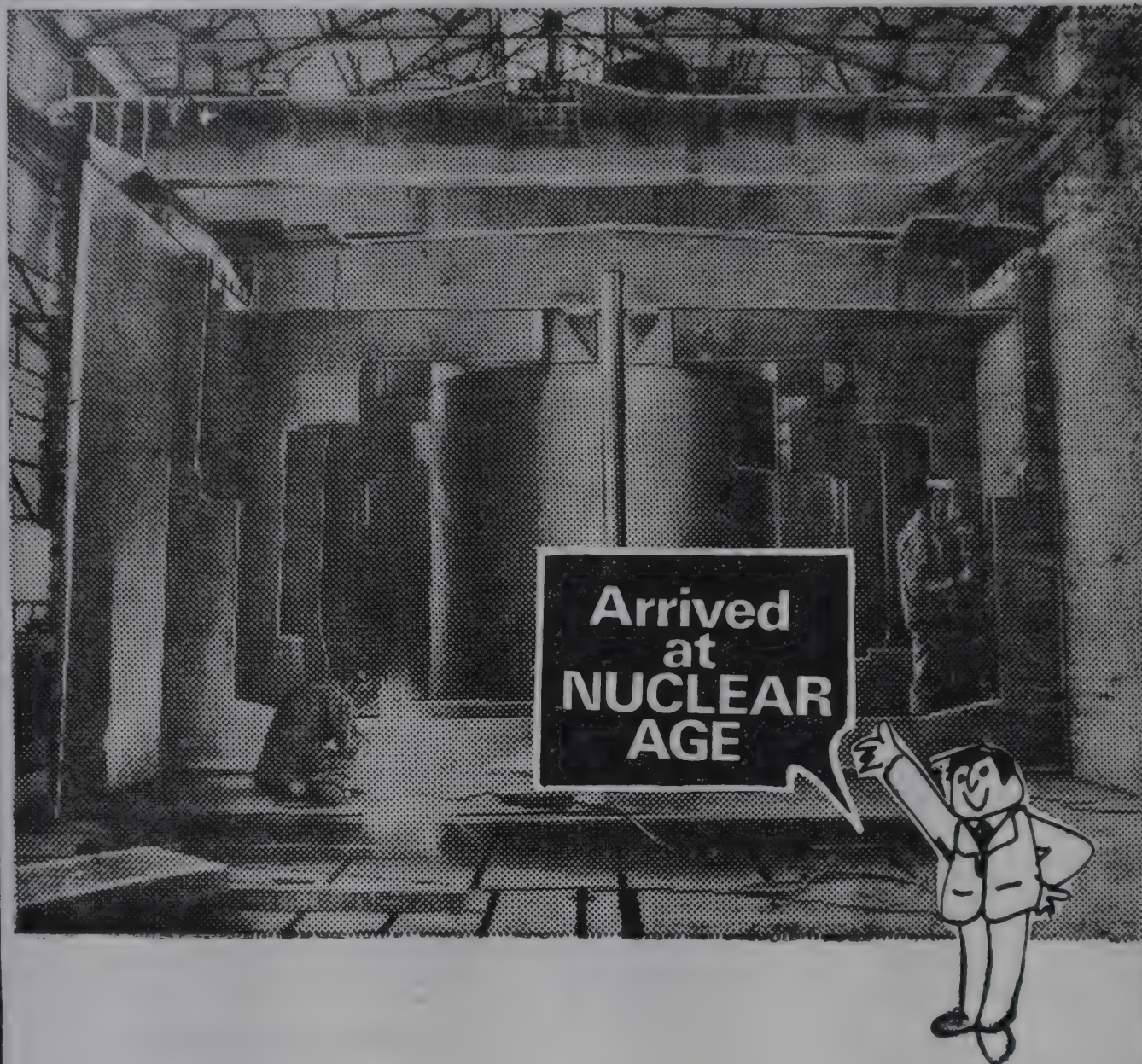
Whether hydroponic farms will ever proliferate is questionable. But

other methods of irrigation (which are more efficient than the flooding method), namely sprinkler irrigation and drip (trickler) irrigation have been prac-

Table 4 : Utilisable surface water resources

River basin	Utilisable water ($\times 10^6$ ha.m.)
1. Narmada, Tapi, Godavari, Krishna, Canveri and other Southern rivers	24.67
2. The Indus system	4.93
3. The Ganga system	18.50
4. The Brahmaputra system	1.23
5. The Mahanadi and other east flowing rivers	12.34
6. West flowing rivers excluding the Tapi and Narmada	4.93
Total	66.60

SOURCE : Report of Irrigation Commission.



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used in various countries, to advantage, under suitable circumstances. In the USA and Russia, about 10 per cent of the irrigated area is under sprinkler irrigation, while in Israel about 90 per cent is irrigated by this method. In our country it got started in the fifties, but never caught on.

The advantage of sprinkler irrigation is that, with a limited quantity of water, a substantially larger area can be irrigated by sprinklers than by flooding method. But it requires an initial investment on pumps, pipelines, nozzles, etc. Sprinkler irrigation is particularly suited where the land is undulating. Theoretically sprinkler irrigation can be applied to any crop other than rice and jute. However, its advantage is not uniform for all the crops.

There are many areas in the country where this method would be more useful. Most coffee and tea gardens are ideally suited for spinkler irrigation.

In the drip or trickler irrigation method, irrigation water is conveyed along furrows in 12 to 16 mm diameter tubings and allowed to drip slowly through orifices at practically zero pressure to keep the soil surface around the plants constantly wet. This method eliminates the evaporation loss which occurs in spinkler sprays. A high degree of salt concentration is not reached in the root zone because of constant wetting.

This method of irrigation has been found to be very useful in Israel. In India, we have large areas in Gujarat, Saurashtra and Kutch with conditions similar to that in Israel, where this method may be used beneficially.

Can we increase the supply? Is there any way of increasing the amount available when and where it is needed? There are a number of methods, some proven and others potential. Some of the methods are: (i) Weather modification, (ii) desalination, (iii) reduction of evaporation and (iv) artificial recharge of aquifers.

Weather modification: Attempts to modify the weather began many decades ago, but they did not bring any success till 1946 when a few pounds of dry ice were dropped above clouds in Pittsburg (Pennsylvania), USA, and snow immediately fell over a wide area. Since then many nations have been conducting research work in weather modification by cloud seeding. In India

cloud seeding experiments have been carried out since 1952.

The current feeling on this is that rain can be produced locally on a modest scale provided suitable clouds are present and other specific conditions exist. More research should be carried out on a wide scale before counting on artificial rain as a source of water in planning river valley project.

Desalination: The first land-based commercial desalination units were built more than 45 years ago. At present desalinated water is expensive. The desalination process in Kuwait, which is among the cheapest, has been reported to cost about Rs 3 per 1000 litres⁶. In areas of acute water shortage, there can be economic justification for the use of high-cost water for industrial and domestic use. At some future date, when nuclear energy becomes economical, desalinated water may be used for supplemental irrigation of high-value crops.

Artificial recharge: This is not a new source of water. In estimating the utilisable surface water resources an assumption was made that, because of lack of suitable sites for storage, a large percentage of monsoon water in rivers like Ganga will continue to flow to waste. It is this water that is proposed to be put to use with artificial recharge of aquifers. This is done by pumping down the ground water level during the eight months of dry period and recharge the aquifers with monsoon waters that otherwise would have flown to waste. About 6 x 10⁶ ha.m. are expected to be utilised in this way in Ganga basin above⁹. Detailed studies are still to be done.

Conclusion

Self-sufficiency in food production is a vital necessity for Indian economy. A large country like ours cannot depend on substantial imports of food. Food production in the country in 1974 was about 104 million tons. Expectations have been higher in 1975, because of good monsoon. Even in a good year like 1975,

the food produced is barely enough to meet the average nutritional demand. Averages are deceptive. The poorer segments of the population get much less than the required amount of nutrition.

To increase the food production for the growing population, agricultural production should be increased. Water is the prime requirement for increasing agricultural production. Only when there is enough water can we use other input like high yielding varieties, more fertiliser, etc.

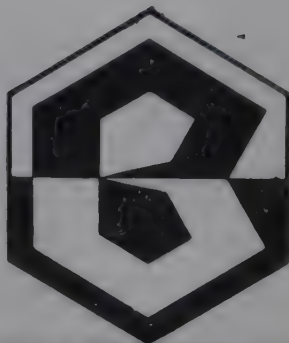
The total utilisable water resources of the country are estimated to be 87.0 x 10⁶ ha.m. With this water, after allowing for increased domestic and industrial demand, we may be able to double our area irrigated in the next 25 years.

In order to be self-sufficient in food in addition to doubling the area under irrigation, we have to increase the efficiency of irrigation. Efforts also should be made to store the monsoon waters, that cannot be stored on the surface, underground. Research should be done on weather modification by cloud seeding, desalination and reduction of evaporation losses, and thus increase our water supply position.

References and notes

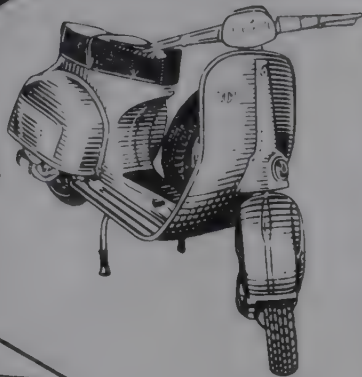
1. Irrigation Commission of India, *Report of the Irrigation Commission* (Ministry of Irrigation and Power, New Delhi), 1972.
2. J. D. Gavan and J. A. Dixon, 'India: Perspective on the Food Situation,' *Science U.S.A.*, V. 188, n. 4188, 1975.
3. A. L. Merrit and B. K. Watt, 'Energy Value of Foods,' *U.S. Department of Agriculture Agricultural Handbook No. 74*, 1973.
4. Adopted from: D. H. Meadows, et. al., 'The Limits of Growth,' *New American Library*, N.Y., U.S.A., 1972.
5. A. N. Khosla, 'Appraisal of Water Resources Analysis and Utilization of Data,' *Central Power, Irrigation and Navigation Division India* (Mimeographed), 1950.
6. K. V. Raghava Rao, et. al., 'An Estimate of the Ground Water Potential of India,' *Soil and Water Management Symposium*, Hissar March 1969.
7. Water in Industry, *National Association of Manufacturers*, U.S.A., 1965.
8. Water Desalination in Developing countries, *United Nations*, 1964.
9. R. Revelle and V. Lakshminarayana, 'The Ganges Water Machine,' *Science*, U.S.A. V. 188, N. 4188, May 1975.

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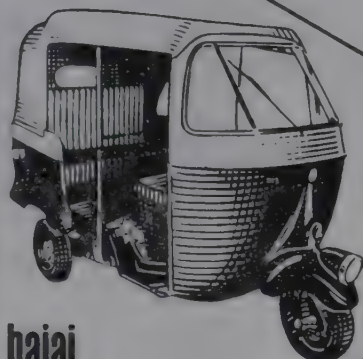
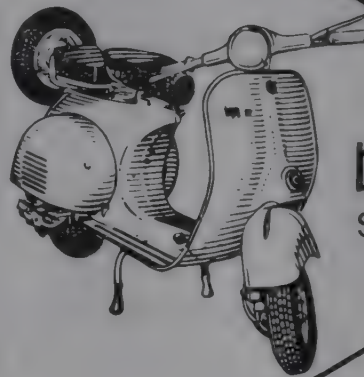


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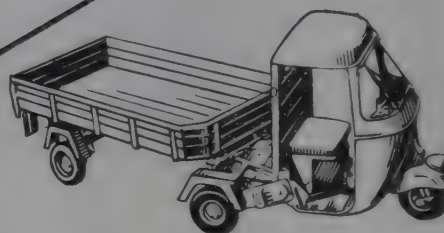
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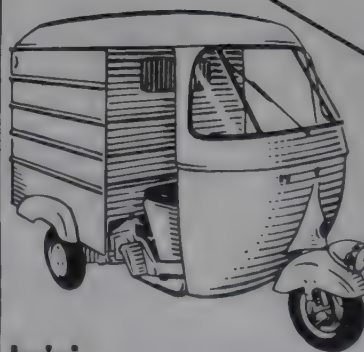
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Quality of irrigation water

By K. V. Paliwal

THE water quality of Indian perennial rivers is quite good for irrigation purposes (Table 1). But some rivers of arid regions particularly of Gujarat show considerable salt concentration as they flow seasonally through salt-affected regions. The quality of canal waters is also quite good because of their origin from the river waters which are of good quality.

Broadly speaking, the water quality of groundwater resources of the country can be divided into three groups: (1) water quality of arid and semi-arid regions having rainfall below 400 mm per annum consisting of Gujarat, Rajasthan, North-western part of UP (Agra and Mathura) adjoining Rajasthan, Ferozepur, Bhatinda and Sangrur districts of Punjab, and Rohtak, Gurgaon, Mohindergarh and Hissar districts of Haryana; (2) water quality as influenced by high water table and waterlogging conditions consisting of some of the areas of Punjab, Haryana, Delhi and UP in canal irrigated areas and river basins and (3) water quality of wells in some areas of coastal regions as influenced by sea-water intrusion and inundation in the States of West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra and Gujarat.

The groundwater forms a major source of irrigation in Gujarat and Rajasthan but is of poor quality. In western regions of Rajasthan and Gujarat, the water potential is not only low but is also of very high salinity. And in the absence of an alternative source of good quality water, farmers invariably use poor quality water for irrigation. Crop productivity in such regions is reduced by 25 to 50 per cent of the normal and crop failure is common during the drought years.

Under minor irrigation projects, some areas are irrigated by lakes, tanks and reservoirs in which rain and drainage waters are collected. In Rajasthan, large areas in the districts of Ajmer, Bhilwara, Jaipur, Alwar and Bharatpur are irrigated by tanks. The tank waters are also of good quality, except for a

few in Andhra Pradesh which show low to moderate salt concentration.

Quality of drainage waters of Godavari and Pravara in Deccan plateau is of medium salinity. The quality of channel waters from perennial rivers presents no problem in Karnataka while those flowing over the arid region with scanty flow are found to show adverse effects on soil. In UP, drainage channels have been found to show moderate to high salinity (1.4 to 2.0 millimhos/cm).

Chemical composition

Aridity is the most important single factor responsible for high salinity of the groundwater. The consolidated data on 4,200 well waters of Rajasthan show (Fig 2) that 28 per cent are highly saline having electrical conductivity above 5,000 micromhos/cm. Their mean chemical composition also reflects that upto moderate salinity level (3-4 mmhos/cm), calcium and magnesium are relatively more, but on increasing salt concentration sodium is the major ion (Fig 2). In these waters, calcium is quite low and forms less than 10 per cent of the total salt concentration, while magnesium is always more than calcium throughout the salinity range and has almost the same Mg/Ca proportion in relation to salinity. In case of anions (Fig 3) chloride ion concentrations regularly increase with salinity while carbonate and bicarbonate ions increase at low salinity and then decrease with increase of salinity. Sulphate forms less than 20 per cent of the total salt concentration and is further decreased at high salinity levels. On the basis of these curves (Fig 2 and 3), it is possible to assess ionic composition of a natural water at a particular salinity.

The mean chemical composition of well waters in some districts of Rajasthan, UP, Haryana, Punjab and Delhi shows (Table 2) severe salinity problems in the groundwater of western Rajasthan and a few localised areas of other states. Extremely poor quality waters have been found in the districts of Bikaner, Barmer, Jaisalmer, Jodhpur, Pali, Bhilwara, Ajmer and Nagaur of Rajasthan; in Mathura of UP; and in Mohin-

dergarh, Rohtak, Hissar and Gurgaon of Haryana and in western areas of Gujarat and Delhi. However, moderate salinity exists in the central regions of Rajasthan and the districts of Unnao and Agra of UP, Ferozepur and Bhatinda of Punjab, and Baroda, Mehsana and Kaira districts of Gujarat.

Suitability for irrigation

The suitability of irrigation water is mostly judged on the basis of its salt concentration, proportion of sodium to other cations, bicarbonate concentration and boron content in water, soil properties including drainage and salt tolerance behaviour of the crop in a particular climate. Generally, irrigation waters having EC value of 2, 4 and 6 millimhos/cm are quite suitable for salt tolerant crops grown on clayey, loam and sandy soils, respectively.

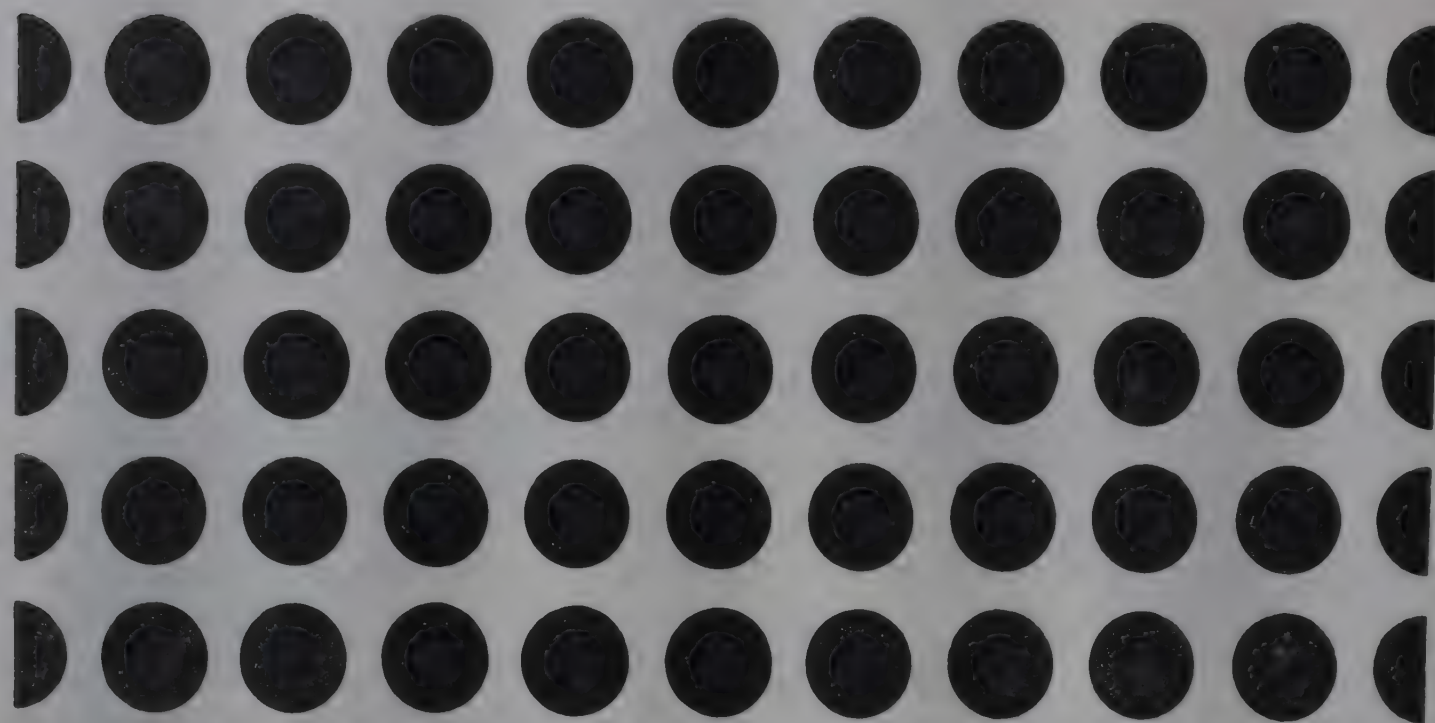
The adverse effect of saline water on soil properties and crop growth in-

Table 1 : Quality of river waters*

River				Electrical conductivity (micromhos/cm)
Brahmaputra	..	..	..	177
Ganga	..	..	..	274
Yamuna	..	..	..	647
Godavari	..	..	..	725
Kaveri	..	..	..	269
Narmada	..	..	..	329
Tapti	..	..	..	551
Chambal	..	..	..	448
Gandak	..	..	..	253
Sutlej	..	..	..	235
Vyas	..	..	..	260
Kosi	..	..	..	142
Kali Nadi	..	..	..	660
Krishna	..	..	..	1392
Tunga Bhadra	..	..	..	1730
Hagari	..	..	..	1640
Sengar	..	..	..	1048

SOURCE : *Paliwal, K. V. (1972), *Irrigation with Saline Water*.

Dr Paliwal is Senior Irrigationist at Water Technology Centre of Indian Agricultural Research Institute.



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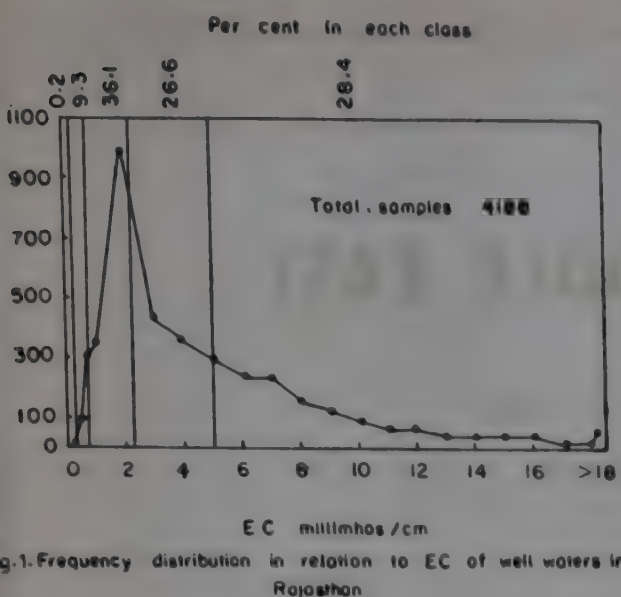
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reases with the concentration of salts and sodium bicarbonate and boron content. However, if the waters carry considerable amount of potassium and nitrate ions as they occur in some well waters of Rajasthan, Punjab, Haryana and UP, more saline waters can be successfully used as these ions regular-

ly supply the nutrients to the plant which are essential for their growth.

Accumulation of salts increases with the fineness of the soil texture, amount of water applied and the duration upto which it stands on the soil surface. Hence, the degree of harmful effect will be less on light textured soils where salt accumulation is much less as compared to that on heavy soils.

Due to the continuous use of saline irrigation water, area of the salt affected land in the country is increasing regularly. In Rajasthan alone about 56 per cent of well water irrigated area has been affected with the problem of soil salinity and alkalinity, and more areas are gradually being affected in other irrigated regions. And in some areas soil salinity is due to poor management even in using good quality waters. It is estimated that there are seven million hectares of salt-affected lands in the country and due to their

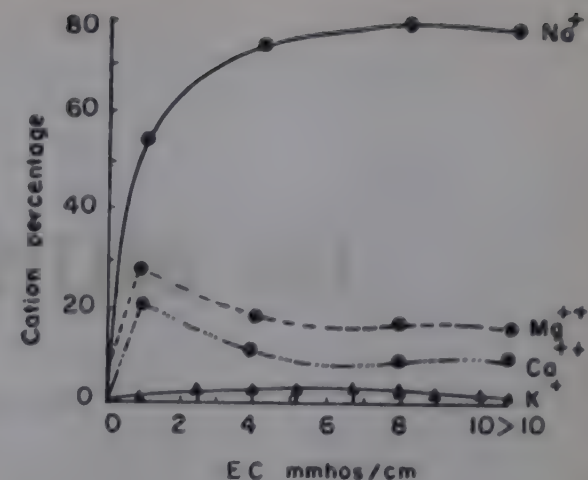


Fig. 2. Per cent distribution of cations in relation to EC in well waters of Rajasthan

low crop productivity there is an annual loss of 400 crores of rupees.

Management practices

By adopting proper management practices, it is quite possible to increase crop productivity sufficiently and large tracts of land can be saved from further deterioration, and land and water resources can be much better profitably utilised for the maximization of yield potential of the country. However, the choice of the management practices should be strictly determined by the local conditions. But for successful implementation of the package of practices, the quality of irrigation water with respect to the total salt concentration and ionic composition and the degree

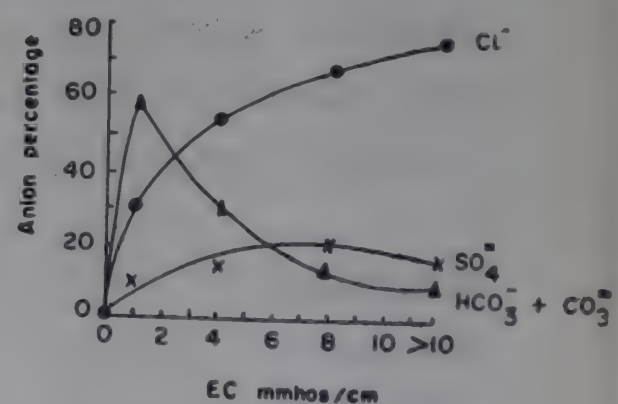


Fig. 3. Per cent distribution of anions in relation to EC in well waters of Rajasthan

of salinity and alkalinity of the soil should be known before adopting any of the management practices. Some of the management practices are as follows:

(1) *Reclamation - cum - cultivation*: Since the reclamation of highly deteriorated saline-alkali soils is a long-term process, it is desirable to bring the soil condition upto moderate levels of salinity and alkalinity by usual reclamation measures and keep the field under cultivation. This will improve soil fertility and also the physical and chemical properties of the soil.

Table 2: Mean salinity in the well waters in the districts of different States

District	Electrical conductivity (micromhos/cm)		District	Electrical conductivity (micromhos/cm)		District	Electrical conductivity (micromhos/cm)	
Rajasthan			Punjab					
Ajmer	..	5500	Aligarh	..	1163	Jullundher	..	768
Alwar	..	2407	Bulandshahar	..	660	Ropar	..	770
Barmer	..	5180	Etah	..	930	Ludhiana	..	810
Bikaner	..	6250	Lucknow	..	860	Gurdaspur	..	794
Bharatpur	..	3090	Rai Bareilli	..	1110	Hoshiarpur	..	856
Bhilwara	..	5552	Barabanki	..	590	Kapurthala	..	899
Jaipur	..	2986	Fatehpur	..	1350	Patiala	..	1006
Sawai-Madhopur	..	2195	Kanpur	..	1470	Amritsar	..	1014
Jaisalmer	..	4950	Farukhabad	..	1600	Sangrur	..	1521
Jalore	..	3251	Mainpuri	..	1170	Ferozpur	..	2062
Jodhpur	..	6600	Unnav	..	2213	Bhatinda	..	2668
Nagaur	..	4225	Varanasi	..	836	Haryana		
Pali	..	5087	Azamgarh	..	774	Jind	..	3025
Sirohi	..	2893	Gazipur	..	629	Hissar	..	3490
Uttar Pradesh			Jaunpur	..	789	Gurgaon	..	3390
Nainital	..	420	Mirzapur	..	589	Rohtak	..	5380
Muradabad	..	460	Jhansi	..	860	Mohindergarh	..	6935
Rampur	..	580	Hamirpur	..	2060	Union territory of Delhi	4270	
Badaun	..	450	Banda	..	2140			
			Agra	..	2696			
			Mathura	..	8616			

SOURCE : Paliwal, K. V. (1972), *Irrigation with Saline Water*.

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(2) *Deep ploughing and planting:* In the hard alkali soils or soils with sub-surface hard layer can be slightly improved by deep ploughing and incorporating dead leaves and manure to the soil. Some fertilizers should also be added to make up the fertility losses due to this inversion process. This will improve air-water relationships and also the nutrient availability. After the field is properly leveled, plant should be raised on the slopes of the ridges as the salts will move up leaving the root zone in an environment of low salt concentration.

(3) *Use of fertilisers:* The fertility status of saline water irrigated fields is generally poor and it is essential to raise the fertility status to meet the nutrient requirement of the crop. But excessive fertilization or application of fertilizers to a highly saline-alkali soil is a waste. Experiments on wheat, barley, maize and bajra and other crops irrigated with different quality waters revealed that soils having electrical conductivity of the soil solution upto 6.5 millimhos/cm and exchangeable sodium of about 30 per cent can be profitably fertilized with normal doses as recommended for normal soils for the same crop and its variety. Upto these limits of saline-alkali soils, crop yield can be increased from 15 to 45 per cent. However, application of fertilizers is more profitable if applied along with manure. Amongst the fertilizers, nitrogen is better than phosphorus followed by potash. Methods of fertilizer application may be the same as those for normal soils but urea should be avoided while calcium ammonium nitrate or ammonium sulphate be preferred. In alkali soils, green manuring is equally effective, but availability of good quality water and sufficient period between the crops is a pre-requisite for the decomposition of green manured crop as otherwise one crop has to be missed. If green manuring is to be adopted, *dhaincha* (*Sesbania aculeata*) should be preferred.

Choice of crop

In areas irrigated with saline water, it is desirable to grow salt resistant varieties. High yielding varieties of wheat and barley recommended for the area do well in moderately saline conditions. However, *Kalyan Sona* variety of wheat and *RS-17* of barley are quite suitable for saline water irrigated areas. Since both these crops are equally and medium salt tolerant, wheat should be preferred to barley from the economic point of view. Since salinity affects grain yield more adversely than straw, sometimes it is better to grow fodder

crops like sorghum with high seed rate.

In kharif crops, cotton and bajra are quite suitable for moderately saline and alkali soils. Leguminous crops like moong, urd, gram and pea are less salt tolerant and should not be grown. In vegetable crops, palak and radish can be grown if their marketing is convenient. Plum and date palm are quite good for arid and saline regions.

Irrigation management

While irrigating with saline water, it is essential to apply 10 to 15 per cent more water than required for the same crop irrigated with good water, i.e. one or two more irrigations should be given during the cropping period. This additional water helps in leaching down the salts if accumulated in the previous irrigation. Moreover, plants grown with saline water show symptoms of water deficit earlier than those grown with good water because of reduced water availability from poor quality water. For practical purpose, it is better to irrigate more frequently with saline water on light soils and with more amount of water on heavy soils. On

clayey soils improvement of drainage system is essential.

Plants grown with saline irrigation water show osmotic as well as specific ion effects. The undesirable ionic proportion in irrigation water can be improved to some extent by precipitating down sparingly soluble salts of calcium and magnesium as their carbonates and also increasing the proportion of divalent cations. This is usually done by the addition of gypsum to water, soil or both. This practice is more suitable for sodium, magnesium, and bicarbonate-rich and calcium deficient waters.

Continuous irrigation decreases the depth of water table and when it comes within the range of one metre from the surface, the salts are deposited on the surface by capillary action. Hence in order to control soil salinity, there should be a simultaneous drainage system to leach out the salts as well as keep the water table below 1.5 metres. This is a very severe problem in high water table areas of UP, Chambal command area of Rajasthan and canal irrigated areas in Punjab, Haryana and Delhi.

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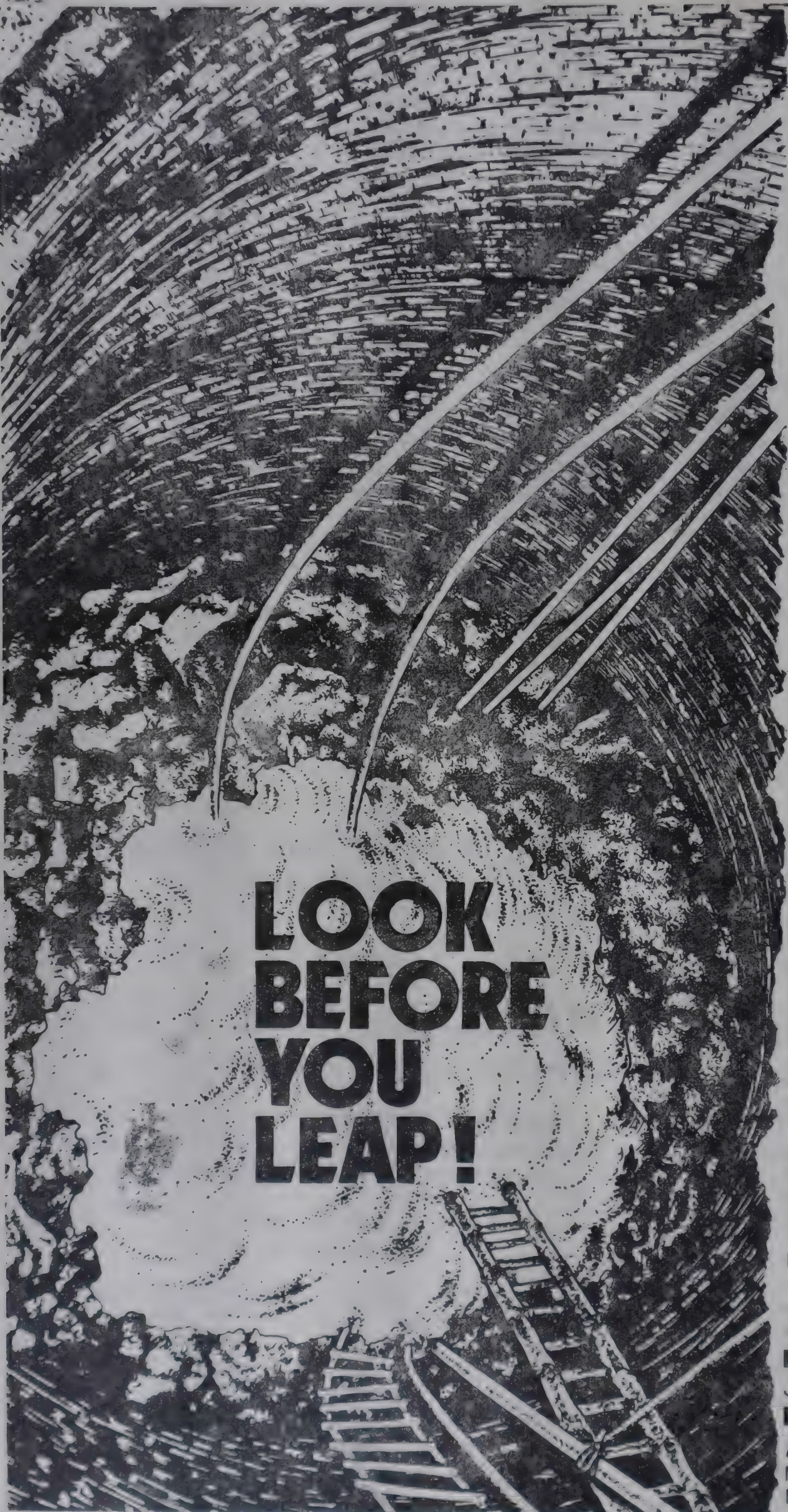
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Planning for ground water

By Hari Narain

WATER is essential for the survival and progress of mankind. The per capita consumption of water is a vital index of prosperity of a country. The demand for water for agriculture, industry and human consumption continues to increase very rapidly. An assured water supply is an essential prerequisite for modern agriculture and industrial growth.

The hydrological cycle is the vast natural water resource system. Oceans contain 97 per cent of water in this cycle. Out of the remaining, roughly 5 per cent is stored in polar ice and glaciers, 11 per cent in groundwater up to depths of 2,500 ft, 13.5 per cent in groundwater at depths greater than 2,500 ft, and the rest, i.e. 0.5 per cent is available in lakes, rivers, soil moisture and atmosphere. The groundwater thus constitutes a very important element of the hydrological cycle and it complements the surface water in a total water resources development programme.

In India, use of water for irrigation is currently confined to about 40 per cent of the total area under cultivation—about 27 per cent by surface water and 13 per cent by groundwater. The remaining 60 per cent of cultivation still depends upon the annual rainfall and the vagaries of nature. However, the primary use of water is for irrigation, the consumption of water for industrial use and livestock and human beings remaining a very small figure of 4.4 per cent of the total water consumption.

It has been estimated that there are over 100,000 villages in India without any source of potable water, and another 150,000 without adequate resources. Most of India's public health problems arise from lack of protected water supply. The World Health Organisation report for 1974 estimates that barely 9.7 per cent of India's total rural

population has access to safe drinking water.

Groundwater has some distinct advantages over surface water. It is present practically everywhere though its quantity, quality, and mode of occurrence may differ from place to place. Unlike the surface water reservoirs, groundwater does not occupy arable land surface. Large capital outlays for impounding and storage are not required and returns on capital by way of project benefits start immediately. It can be stored for indefinite periods and it suffers no losses due to evaporation. It is comparatively easy to tap as individual wells can be installed at lesser expenses, in shorter time and no large-scale distribution system is needed.

By virtue of its geographical position India gets good rainfall though it is principally confined to the monsoon period. It has a large number of river systems and perennial cover of ice and glaciers in the Himalayan mountain ranges. Adequate replenishable water resources are thus available, and planned programme of conjunctive use of surface and ground water is essential for rapid agricultural, industrial and economic growth of the country, and for meeting the increasing demands of future generations.

Surface tanks

Groundwater has been used in India since times immemorial. Reference to irrigation wells is found in the Vedas. Localised utilisation of groundwater through open wells for irrigation and human consumption continued during the medieval period. Towards the end of 19th century surface tanks and open wells became an important source of irrigation. The Irrigation Commission recognised the importance of groundwater in irrigation as early as 1903. The importance of open wells for irrigation was stressed again by the Royal Commission of Agriculture in 1928. After the acute famines of 1942-43,

concrete programmes for construction of open wells were launched under the Grow More Food Campaign of the Government of India.

The Geological Survey of India has been involved in groundwater investigations and specific water supply projects almost since its inception in 1851. However, a division for groundwater studies was set up only in 1945. The Ministry of Food and Agriculture set up an Exploratory Tubewells Organisation (ETO) in 1954 under the technical co-operation programmes of the USA to work jointly with the Groundwater Division of GSI to carry out systematic and scientific exploration of groundwater resources. By March 1971, the ETO covered a total area of about 235,000 sq km, comprising selected promising parts of nearly all the States. In all 911 exploratory holes were drilled, of which 382 were successful and the rest were abandoned. Simultaneously, the ETO drilled a total of 1,434 production wells in the proved areas, of which 1,183 were successful.

The ETO and the Groundwater Division of the GSI were merged in 1972 and the Central Ground Water Board (CGWB) was formed under the Ministry of Agriculture. The organisation combines the functions of the two and is now principally responsible for systematic hydrogeological surveys, groundwater exploration, resource evaluation and special groundwater projects.

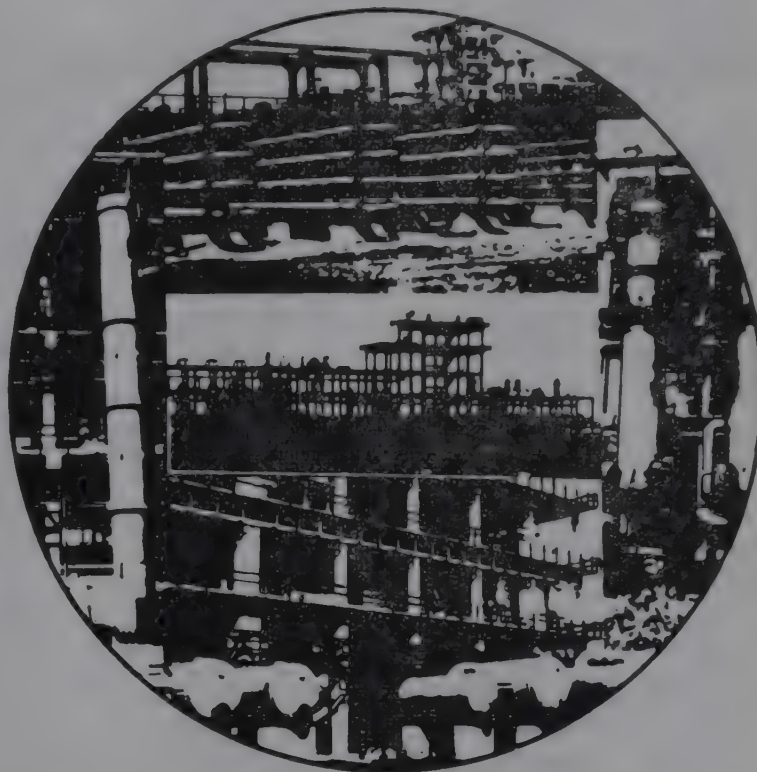
Realising the necessity and urgency of groundwater development programmes, a majority of the State Governments have also established organisations for exploration and exploitation of groundwater.

Geological aspects

India can be classified into three major geographical units, viz, the Himalayan ranges, the Indo-Gangetic plains and the peninsular shield, all having their own peculiar geohydrological settings. Out of the total land area of 3.2

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million sq km of the country, about million sq km is occupied by igneous and metamorphic rocks. Of the remainder, consolidated Palaeo-Mesozoic sedimentary rocks occupy some 0.061 million sq km; semi-consolidated and unconsolidated tertiary sediments are exposed over an area of 0.172 million sq km, while unconsolidated quaternary sediments (alluvia) cover about 0.579 million sq km.

The various geological formations differ in their capacity for groundwater storage. In the Indo-Gangetic plain, the alluvial tracts made of intercalated lenses of gravel, sand and clays, generally have copious supply of water, while in the hard rock areas the yield is comparatively poor because water is located only in the top weathered portions and in fractures and joints. The consolidated sedimentary rocks have intermediate capacity for storage of groundwater.

Projections

It is estimated that systematic hydrogeological surveys are required over an area of 2.6 million sq km in the country. Out of this, an area of about 1.07 million sq km has been studied by the end of Fourth Five Year Plan and the target for additional coverage during the Fifth Five Year Plan period is 0.5 million sq km. Priority is being given to drought-affected and drought-prone areas. The CGWB has taken up special projects in selected areas based on socio-economic as well as hydrological, hydrogeological and hydrometeorological considerations. Two such projects have been completed—one in the Gaya district of Bihar State and another in the arid and semi-arid regions of western Rajasthan and Gujarat States. There are seven similar projects under execution in (i) Narmada River Basin, (ii) Andhra Pradesh and Karnataka inter-State area, (iii) Upper Yamuna region, (iv) Vedavati river basin, (v) Sina and Man project of Bhima river basin, (vi) Amravati and Ponnani basin, and (vii) Ghaggar river basin. A new project in the upper Betwa river basin has also been approved.

The National Geophysical Research Institute has also recently taken up a project on groundwater management studies with West German collaboration, and simulation studies are being carried out in Lower Maner basin of Andhra Pradesh.

Groundwater is mainly used under three categories—irrigation, industrial

and domestic water supply which includes water for animal and human consumption. The progressive picture of total utilisation of groundwater estimated and projected at end of successive Five-Year Plan periods is indicated in Table 1.

Table 1 : Utilisation of groundwater

(In million hectare-metres)

Sector	1968-69	1973-74	1978-79	1983-84	1988-89
Irrigation	8.15	11.25	14.35	17.37	20.45
Industry	0.07	0.13	0.19	0.34	0.52
Domestic and livestock	0.34	0.38	0.46	0.55	0.64
Total	8.56	11.76	15.00	18.26	21.61

SOURCE : Government of India, Planning Commission Report of the Task Force on Groundwater Resources, April, 1972.

Potential

The utilisation of groundwater as a source for irrigation is extremely valuable. The present estimates from the available data indicate that the ultimate potential of feasible groundwater for irrigation is about 27.5 million hectare-metres. As against this figure, the annual utilisation at the end of the Fourth Five Year Plan period is estimated to be of the order of 10.5 million hectare-metres. An area of about 16 million hectares is being irrigated as of 1973-74, whereas optimal utilisation of the groundwater potential will enable us to irrigate about 36 million hectares. The projected figures are gross estimates obtained on very scanty data and broad approximations.

Basin studies

A scientific assessment of groundwater potential of the country is to be achieved through hydro-meteorological and hydrogeological studies, geophysical surveys, test drilling and pumping tests in discrete hydrological units such as a river basin. It is essential to obtain a clear picture of the total surface and sub-surface inflow and outflow, precipitation, recharge, evapo-transpiration, etc, on one hand, and the tectonic, lithological and topographical constraints on the other hand to obtain an estimate of static and dynamic reserves of groundwater in a basin. Integrated multidisciplinary basin studies envisage installation of rain gauges at appropriate locations, stream gauging, lysimeter studies to evaluate evapo-transpiration and nuclear hydrogeological studies for estimation of recharge, besides detailed hydrogeological and geophysical surveys and drilling programmes to indicate the aquifers and their potential. Chemical analysis of well water samples gives information about their suit-

ability for drinking or industrial or irrigation purposes. Modern practices utilising computer facilities and analog and digital modelling provide dynamic models which could simulate the geo-hydrological conditions in a basin and carry out water balance studies for

large scale groundwater exploitation programmes involving estimates of safe yields and optimal spacing of wells. Operation research tools like systems analysis, linear and dynamic programming are also being increasingly used to find solutions to water exploitation and management problems.

Geophysical techniques

Geophysical prospecting techniques are useful in locating aquifers and in giving information about their depth, thickness and lateral extent in sedimentary regions, thickness of water-bearing weathered zone and depth of bedrock in the hard rock areas, quality of groundwater in terms of salinity, location of zones of sea-water encroachment in coastal areas, etc. Such information when coupled with the knowledge of geological and hydrological conditions can usefully indicate areas favourable for groundwater exploration and in actual siting of wells at most favourable locations.

Drilling of deep tubewells for drawal of groundwater is very costly and cost benefit ratios can be greatly improved if the drilling sites are decided on the basis of geophysical surveys in the area. For example, in Israel success ratio in groundwater drilling has been raised from 35 per cent to 85 per cent with the help of geophysical surveys.

Planning for groundwater resources

Land, soil, water and forests form integral and inter-dependent major constituents of our replenishable natural resources. Exploitation measures or management practices pertaining to any of these resources are bound to affect the others and it is, therefore, essential that short-range as well as long-range planning for

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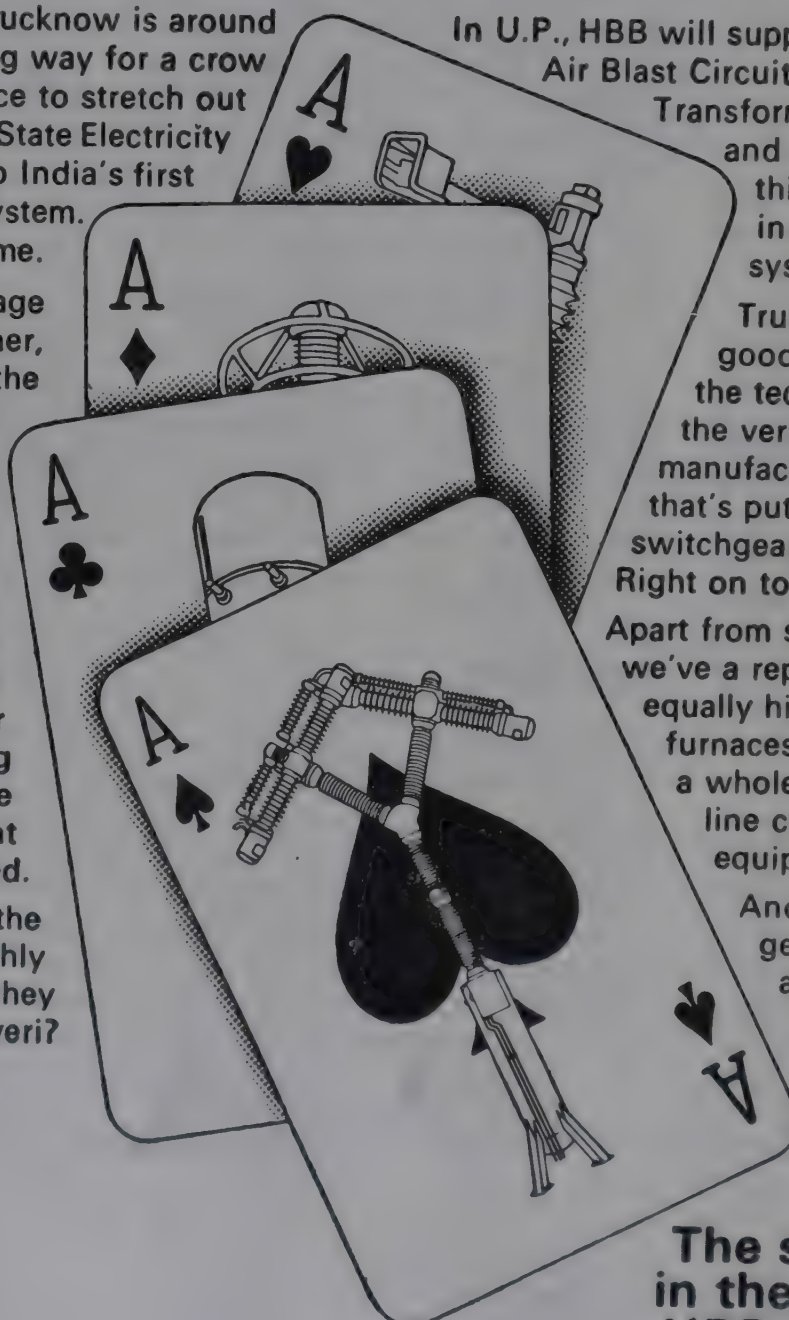
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development of groundwater resources forms an integral part of the overall development plans for the entire sector of natural resources. Planning for groundwater resources attempted in isolation is bound to create imbalances with the other constituents of the system.

In any large scale exploitation programmes for groundwater, it is necessary to study the various components of the entire hydrological cycle. Multi-purpose surface water development programmes involving construction of large dams, canal systems and river link projects have direct bearing on groundwater regimes and fluctuations of water table. Planning for groundwater has to be in consonance with the surface water availability and utilisation in view of their interdependence. Irrigation being the major item demanding groundwater supplies, an overall plan of conjunctive use has to be drawn up to meet the agricultural demands.

As the groundwater regime is a replenishable system, a comprehensive management plan for groundwater development should necessarily include estimation of re-charge and optimum withdrawals from such a system.

Groundwater planning should involve (i) large scale systematic hydrogeological, hydrological and geophysical surveys and water balance studies in the various river basins; such studies should spread over the entire country including the hard rock areas, priority being given to drought-prone and drought-affected areas; (ii) techno-economic feasibility studies on conjunctive use of surface and groundwater to meet the agricultural and industrial needs of the area; (iii) large scale pumping of groundwater into suitable surface water channels could lower down the water table sufficiently to absorb the flood waters during monsoon months in the foothills and Tarai areas south of the Himalayan Ranges and other similar areas where water table is very high; (iv) priorities for groundwater exploitation in drought-prone areas should be so planned that at least drinking water is available during the drought periods when rainfall has been scanty; (v) detailed geophysical studies in regions indicating high salinity to delineate the areas of saline waters and to explore the possibilities of fresh water aquifers either above or below the saline water zones. Such studies elsewhere in the world have helped provide fresh water for drinking and agriculture purposes, limiting the use of saline waters for industrial purposes; (vi) studies in land utilisation pattern

and land management practices which influence the rate of infiltration and groundwater re-charge to a great extent; and (vii) canal irrigated areas where waterlogging and salinity have become serious problems. Groundwater development programmes in such areas will help to lower down the water table and reclaim arable land.

Management aspects

Unfortunately, the entire sector of water is being handled by a number of Central Ministries and State departments and it has been severely compartmentalised into major irrigation, minor irrigation, rural development, Panchayat Raj, industries and various other user departments and agencies who approach the exploitation programmes from their isolated and narrow angles overlooking the repercussions which such an approach may have on the other user agencies as well as on the total water regime of a basin.

Systematic collection and analysis of data is one of the pre-requisites of any planning process. In India, a considerable amount of work has been done and a large number of wells have been drilled by various agencies in different parts of the country. The data thus obtained are scattered and locked up in the files of the various State and Central agencies. The first necessary step is to collect all the surface and groundwater data and analyse them basin-wise. The deficiencies in data should be made up by additional investigations to present an adequate basin-wise picture for planning.

The financial outlays for programmes of development of water resources have considerably increased over the Five Year Plan periods. It is estimated that over Rs 2,032 crores will be invested in assessment and exploitation of groundwater resources during the Fifth Five Year Plan period. It is essential to ensure that these investments provide optimum returns and the programmes are carried out on sound scientific and technological considerations in conformity with the long-term basin-wise plans.

The short-term planning and execution of the groundwater programmes for immediate needs have to be carried out on the basis of the collection of the available data, their analysis, synthesis and extrapolation by empirical correlations as required. These plans must form a component of the overall plan for the entire river-basin. The techniques and methodology employed in planned development of groundwater resources may be periodically reviewed and refined as more and more hydro-

geological information is collected. It is visualised that progressive analysis and interpretation of the data thus collected in course of time will eventually provide sophisticated basin-wise management of the groundwater systems through dynamic modelling techniques. The coarse models assumed for initial plans will continue to be refined as more data are available while an integrated optimal water management programme is evolved.

Water is a State subject and the clash of interests and inter-State disputes create problems in planning, exploitation and management of the water resources. Conjunctive use of surface and underground water, understanding of the behaviour of the rivers to exploit them and reduce their flood damage requires a well co-ordinated and centralised planning. The enormity and urgency of the water resources management make it imperative that all concerned organisations within the Central Ministries and State departments pool their resources towards such an integrated programme.

The success of land and water development programmes is dependent upon the level of financial assistance available to the farmers. A study of the land-holding sizes indicates that about 75 per cent of operational land-holdings are below three hectares, and earnings from such small plots can hardly provide for investments in wells and pumps. The conjunctive use of surface and groundwater which is essential in any irrigation scheme would necessarily call for financial support from the Government for successful implementation of the programmes.

Future outlook

The present assessment of the groundwater potential indicates that an area of nearly 20 million hectares can be brought under groundwater irrigation in addition to the present 16 million hectares. Assuming that an average expenditure of Rs 300 per hectare is needed to exploit the groundwater potential—the figure indicated by the Planning Commission—the cumulative investments would be of the order of Rs 5,800 crores.

The outlay on irrigation programmes in the Five Year Plans and their projections indicate that sufficient capital should be forthcoming if the country chooses to harness the full potential by 2,000 AD. Finances, therefore, do not seem to be a bottleneck. The real problems are timely decisions and the execution of the programmes.

The cost of delays in decision-making and in the implementation of the programmes is tremendous.

Having once decided the scientific and technological tasks of the long-term integrated plans, it is essential to work out the total man-power requirements and the equipment which may be required to fulfil the tasks. The integrated plan has to ensure that man-power training and manufacturing facilities for the equipment required indigenously are established simultaneously to fulfil the planned targets.

Any planning for groundwater development programmes will be inadequate and grossly defective if groundwater pollution hazards are not kept in mind. Human and animal wastes and increasing use of fertilisers create groundwater contamination by nitrates, and surface water pollution by organic and inorganic materials and by bacteria. Extensive use of DDT over a number of years has recently revealed its bad effects. The disposal of industrial effluents poses another problem of water quality management. At the same time, it is also important to realise that deeper groundwater regimes offer excellent waste disposal media for radioactive and chemical wastes provided they are well studied.

Artificial recharge, improvement in well technology, quality control, desalination and artificial rain-making are some of the areas which require immediate attention for long-range developmental programmes. Research and developmental activities in this vital sector need be pursued with vigour.

The Task Force reports of the Planning Commission and the Science and Technology Plan prepared by the National Committee on Science and Technology for the sector of Natural Resources deal comprehensively with the survey tasks, basin studies, exploitation, management, research and development programmes required for water resources sector. Integrated plans have been formulated and financial and man-power requirements have been projected. However, these detailed exercises completed over the last three years, and many others undertaken earlier have not yielded desired results.

The planning processes of the concerned Central Ministries and State Departments and implementation of plans still remain compartmentalised towards their own immediate needs and expediency. Dams are being constructed without afforestation and soil conservation programmes in the catchment areas. Canals are being dug with-

out studies of water table fluctuation and proneness to waterlogging in the canal irrigated terrains. Tubewells are sunk indiscriminately resulting in over-exploitation and drying of wells in some areas. Drought mitigation programmes and flood-control measures are attempted without adequate data collection and analysis. Many projects and programmes are being implemented in isolation every year. These could yield much better returns if undertaken with full consciousness of their relationship and interplay on other aspects of land, soil, water and forestry practices and management.

The total manpower resources engaged in the field of groundwater exploration, exploitation, management research and development activities have remained miserably low compared to the size of the country and the problems to be tackled. Many of the universities and research institutions have remained isolated from the mainstream of national tasks. Large scale integrated programmes in the replenishable resources sector should focus the attention and efforts of the various concerned organisations towards the national integrated plans and provide useful employment to a large number of unemployed scientists, engineers, technologists and skilled and semi-skilled workers.

India has the manpower, the infrastructure, the financial resources and capabilities to undertake the programmes in this vital sector necessary to provide adequate water supplies for agriculture, industries and domestic consumption and to mitigate the sufferings and losses due to droughts and floods. What the country lacks are integrated plans at national level and their timely execution, a decision at the highest level to treat water as a national asset and unified direction of all concerned State departments and Central Ministries towards common goals and purposes. The tasks are enormous but well within the genius of Indian scientists and engineers. Let us hope that the politicians, planners and administrators realise the necessity of these measures and take steps in the direction of their early implementation.

References

- 1 Hari Narain, 'Groundwater Resources of India', Presidential Address, National Geographical Society of India, Banaras, February 1970.
- 2 Lahiri, A., 'A Long-range Perspective for Indian Water Resources: 2000 A.D.', January 1975.
- 3 Planning Commission Report of the Task Force on "Groundwater Resources" August, 1972.

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Ground water management

By P. B. S. Sarma

GROUND water hydrology deals with the occurrence, movement, development and management of ground water. Ground water is generally referred to as that body of water occurring below the surface of the ground at pressures greater than atmospheric and refers to the water in the saturated zone of a geological formation.

At present, about one-fifth of all the water used in the world is obtained from ground water resources. The demand is still increasing. Hence, proper estimation, harnessing and utilisation of ground water is of major importance in planning water resources of a region.

Of late, use of ground water for agricultural needs has increased greatly in India, because of the relative reliability or availability of ground water and also due to the fact that the surface water potential has reached almost the point of saturation in some States of the country. Besides these factors, the compulsion of extraction of ground water in drought affected areas, the need for more quantity and application of water to high yielding varieties and multiple cropping patterns, development of well drilling technology and other factors etc have contributed to the phenomenal growth of the development of ground water resources in India.

Ground water occurs in the country under extremely diverse geological conditions. About 65 per cent of the total land area in the country comprises consolidated formations, with

about three-fourths of this being made up of crystalline rocks and consolidated sediments while the remaining one-fourth is trap.¹ The remaining 35 per cent of the land area comprises semi-consolidated and unconsolidated formations like alluvial tracts. There is ample scope for development of ground water in these areas.

Ground water, by itself, is not a separate entity but forms a component of the continuum of the hydrologic cycle. Consequently, surface water and ground water must be viewed as two different forms of occurrence of the same total water resources. In this light, the current status of development of ground water resources, the future demands and the management of ground water resources are discussed in this article.

Utilisation of surface and ground waters

With an assumed total average annual rainfall of 1,125 mm (45 in), it is estimated that an aggregate recharge from rainfall to the ground water is of the order of 37 million hectare metres. Another 9 million hectare metres of water is estimated to be the recharge to ground water due to seepage from canals and the irrigation systems. Thus, the total ground water recharge comes to 46 million hectare metres. Of these only about 60 per cent, nearly 27 million hectare metres was assumed to be the utilizable ground water.² Further, it is estimated that the surface water resources may contribute to the extent of 55 million hectare metres of utilizable potential.

Based on the above estimates, as a first approximation, the country's total utilisable water resources potential

can be placed at 82 million hectare metres.³ This limited amount of water is to be utilized efficiently to meet the increasing demands for agriculture, industry, human and livestock consumption and other uses.

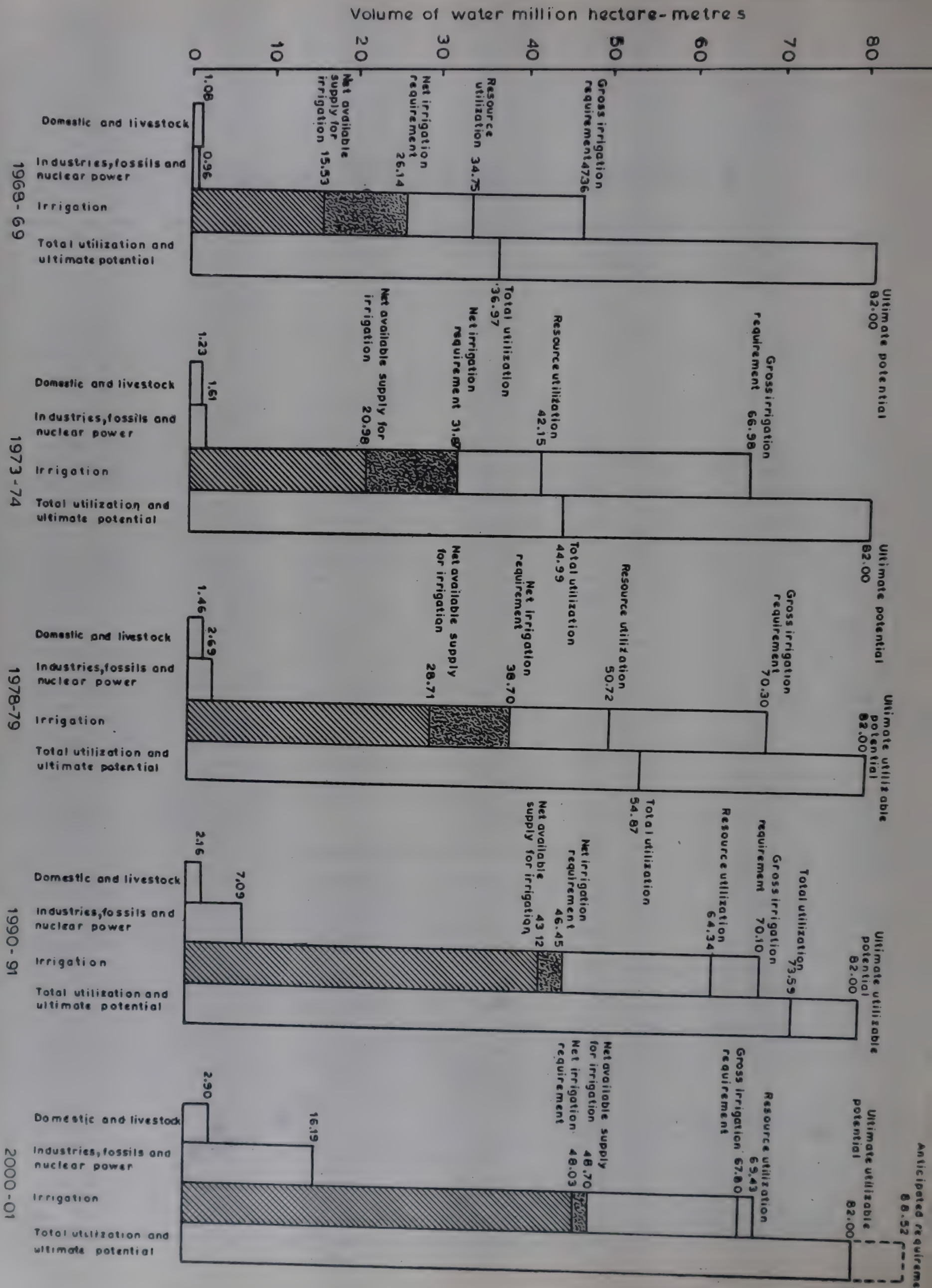
Projections of the demand for water for irrigation, industrial use, human and livestock consumption are presented in figure 1.^{4,5} In the year 1968-69, the irrigation potential was 37.528 million hectares and the corresponding utilisation of water resources was 34.75 million hectare metres.³ For the same year, the consumption of water for industrial needs and for human and livestock consumption are 0.95 and 1.08 million hectare metres respectively. Similar quantities for the years 1973-74, and projections for 1978-79, 1990-91 and 2000-2001 are shown in the figure 1. It is clearly seen that by the turn of the century, the anticipated demand for water exceeds the estimated available ultimate potential.

From the point of view of ground water resources utilisation, further analysis is in order. The present state of development, the potential for irrigation, and present state of irrigation from ground water, are shown in figure 2.⁶ It may be seen that except Punjab, Uttar Pradesh, Maharashtra, Gujarat and Rajasthan, all the other States have not yet developed sizable potential of the ground water resources available in those States. The same situation is reflected in the figures of irrigation from ground water, as shown in figure 2.

Projections of progressive utilisation of ground water through open wells, shallow tubewells and deep tubewells during the period 1968-69 to

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Fig.1. PROGRESSIVE DEMAND AVAILABILITY AND UTILIZATION OF INDIA'S WATER RESOURCES



99 are shown in figure 3.⁷ The number of open wells and tubewells 1968-69 are the same as estimated by Working Group for Formulation Fourth Five Year Plan Proposals for Irrigation and Rural Electrification.⁸ The Task Force on Ground Water Resources⁹ has estimated the annual increment in the number of open wells, shallow tubewells and deep tubewells to be 1,70,000, 100,000 and 10,000 respectively. Based on this estimate, the number of open wells, shallow tubewells and deep tube wells for the period 1973-74 to 1998-99 have been estimated. While arriving at these numbers, allowance was also made for the depreciation on the life of the different categories of wells.

Thus, from the brief review of the present status of the development of ground water resources, future scale of development and the future demand for water resources, it is seen that by the year 2000, not only the remaining ground water potential will have to be exploited fully but also the total demands for water exceed the present estimates of the ultimate water resource potential. This poses the questions such as what needs to be done to meet this additional demand and what of the future years after the year 2000? The present generation has the responsibility of planning for the future. This calls for a different approach that involves scientific management of limited water resources.

Management of ground water

The management of the water resources has to be conducted at two basic levels. The first one is on a macro scale that involves modulation of floods, control of evaporation from large reservoirs, conjunctive utilisation of stream aquifer systems, etc. The other is the micro level water management which essentially involves the effective utilisation of the available water resources. Reduction of seepage losses from canals, improving water conveyance efficiency, reduction of on-farm water losses, conservation of moisture in the root zone etc, constitute water management at micro level.

Khosla¹⁰ estimated that about 55 per cent of the total rainfall is lost due to evapo-transpiration. It was also estimated that almost 62 per cent of surface water resources are lost in the conveyance systems through seepage.³ Thus, any effort to minimise losses due to evaporation and seepage will go a long way in conserving water and increasing the utilisable potential. Several research problems on these aspects are underway at the Water Technology

Centre of the Indian Agricultural Research Institute, New Delhi, and several other ICAR research institutions and agricultural universities.

Large scale aquifers

There is a pressing need for management of ground water not only to meet the future demands but also to ameliorate the problems resulting from bad management. Severe lowering of ground water levels results in increased pumping costs and sometimes subsidence etc and in many coastal ground water areas, ground water utilisation has gone on without restraint until the problem of salt water intrusion showed up. Improperly constructed and abandoned wells may act as cross connections between aquifers and allow poor quality water to move from a degraded zone to aquifers of fresh water. It is worthwhile to note that most of these problems are man-made and, therefore, can also be prevented through proper management of the ground water.

The tools, techniques, and qualified technical specialists to explore, evaluate and manage the ground water resources are now available in India. All that is needed is a concerted effort to use these tools and personnel so that society can benefit from the accessibility, availability, dependability, and general uniform quality of this large supply of water.

Ground water reservoir management in India requires detailed studies to regulate and maintain a long-term hydrologic balance so that the ground water is exploited on a sustained basis. The status of ground water reservoirs and their future management in India is depicted in figure 4. The most potential ground water reservoirs of India lie in the drainage basins of the major rivers of northern India in the States of Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal and Assam. These aquifers have ample scope of recharge. However, the future management of these reservoirs greatly depends upon the understanding of the interrelationship of the surface and ground water bodies and conjunctive use of the water resources. Further, in the deltas of Godavari, Krishna and Cauvery rivers, ground water is under active exploitation specially from the shallow aquifers.

The exploitation of these reservoirs has increased at an unprecedented rate during the last decade and further indiscriminate tapping of these zones is most likely with the increasing emphasis on high yielding varieties of crops and multiple cropping. It is, therefore,

desirable to manage these reservoirs on scientific basis.

The area south of Indo-Gangetic plains spreading into the States of Rajasthan, Madhya Pradesh, Bihar, Gujarat, Maharashtra, Andhra Pradesh, Orissa, Karnataka, Kerala and Tamil Nadu comprises a hard rock area. The areas are yet to be precisely delineated. The ground water supply in these basins is limited and largely depends upon the geologic framework. The management of ground water in this zone will closely depend upon the precise quantitative determinations of usable storage and the recharge components etc.

There are ground water reservoirs with ample scope for recharge along the sub-mountain tracts of Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh in the west and Assam and Meghalaya in the east. The nature of these areas is such that the place of ground water use is usually at a higher location from the point of ground water extraction. Therefore, the extraction of these reservoirs depends upon the economics of the lift involved.

There is a narrow band of artesian ground water reservoir extending from Himachal Pradesh to Bihar through Uttar Pradesh. Such artesian aquifers also exist in the eastern coastal areas of Tamil Nadu. These artesian ground water reservoirs have fairly large scope for recharge and the future management of these reservoirs depends upon efficient design of wells and appropriate land development and drainage practices.

Ground water information relating to the arid and semi-arid climatic areas of Rajasthan, Punjab, Haryana and Gujarat is lacking. The recharge to ground water reservoirs in this zone is very limited.

The above discussion primarily deals with the exploration and evolution of the existing ground water potential developed through the natural recharge process occurring over thousands of years. The Central Ground Water Board has taken up detailed studies on many of these aquifers, and information relating to the aquifer characteristics, natural recharge, number of wells to be located in these aquifers etc., is now available with the Board. Such detailed studies are very useful.

There is, however, a great need for creating additional water resources potential through proper management. Artificial recharge operation, and conjunctive utilization of stream aquifer

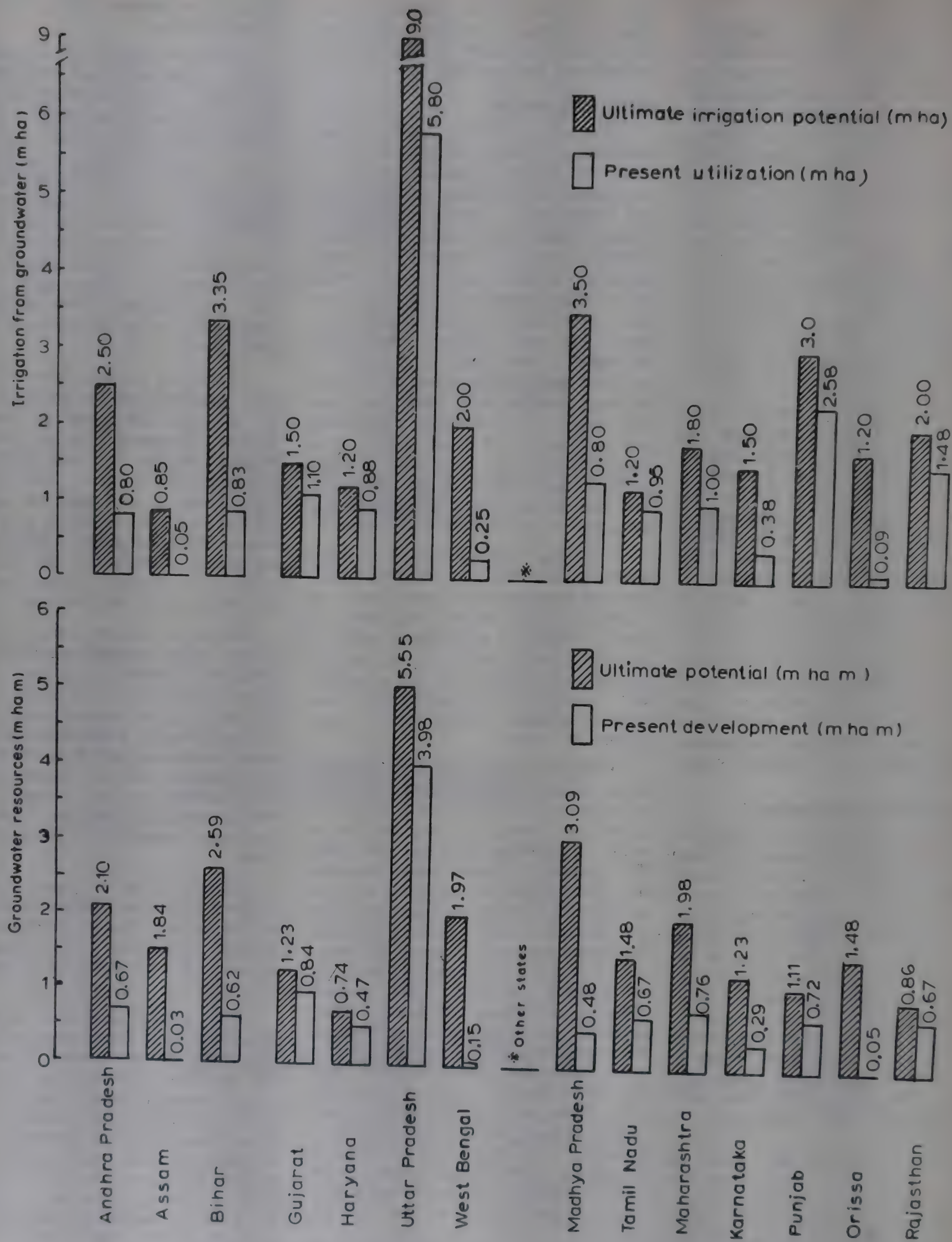


Fig. 2. STATE-WISE POTENTIAL AND UTILIZATION OF GROUNDWATER IN INDIA (1974)

* Information not available

Source: Central Groundwater Board,

systems, play a major role in this direction.

Artificial recharge of ground water

Ground water functions as a stored fresh-water reserve, buffering the rapid changes in the transfer of surface water within the earth's hydrologic cycle. Ground water basins quickly reach a state of overdraft because of man's modification of the historic regional water balance. If the re-establishment of conservation of the stored ground water of a basin is to be done then artificial recharge is one mechanism to accomplish this. The decision must be made whether to attempt to use ground water reservoirs as cyclic storage or to mine the stored water.

Artificial ground water recharge has been used successfully as a water management tool to help meet regional water requirements. Recharge can be used to:

- (i) Maintain or augment natural ground water to preserve it as a continuing economic resource.
- (ii) Prolong the economic use of natural ground water until a surface water supply is available.
- (iii) Combat adverse conditions such as intrusion of sea water and local saline waters caused by overdraft.
- (iv) Provide sub-surface storage for local or imported surface waters or both.
- (v) Provide a sub-surface distribution system where an economy has developed on ground water.
- (vi) Provide for dilution of waste waters prior to reuse and provide the throughflow required for basin salt balance, and
- (vii) Reduce the rate of land subsidence due to extraction of fluids and thus minimize damage to engineering structures sensitive to minor movements of the land surface.

Artificial recharge can be an effective tool in the management of a ground water basin's resources. However, the benefits derived depend greatly on all the variables (economic, political, geologic, physical, etc.) that are associated with each individual management unit.

Conjunctive utilisation of river aquifer systems

Ground water basins are used in conjunction with surface water systems in order to obtain the most efficient operation of the system. The actual number of possible combinations of plans for the co-ordinated operation of

the system is infinite; however, only a few of these plans are physically feasible. From these few, the most economical plan can be obtained. In developing these plans, a primary objective is usually the continued use of the ground water basin into the indefinite future.

Conjunctive use of surface and ground water can take the form of full utilisation of surface water supplies supplemented by ground water. Such conjunctive use may be suitably designed not only to augment canal water supply but also to combat waterlogging and facilitate irrigation with poor quality ground water.

For the conjunctive utilisation of river aquifer systems the case study of the Ganga basin can be briefly mentioned as a very relevant example. Revelle and his associates^{11, 12} reported studies on the optimum utilisation of the aquifer systems of the Ganga basin. The studies envisage the utilisation of monsoon flow of the river Ganga which constitutes nearly 80 per cent of the annual river flow. A major part of this monsoon flow can be stored in the immediate neighbourhood of the river bed in the top 15 to 20 metres depth. With well fields of six kilometres width on either side of the river, the area covered would be of the order of four million hectares.

With an assumed well field capacity of 2.25 M³ per second per kilometre it is estimated that, on the average, the water table will be lowered by about 12 metres at the end of eight months of continuous pumping. This creates an ultimate water recharge potential of nine million hectare metres at the end of four years and the depth of the water table at that time is expected to be about 25 metres below initial level. From the following years onward, the water table is expected to be stabilised at this level by pumping out a quantity equal to consumptive use plus surface drainage plus return infiltration to the ground water table. The total volume of water to be pumped in this scheme is about 10.5 million hectare metres requiring the total well capacity of 5,000 M³ per second.

This system involves use of a considerable amount of electric or diesel power for pumping with an assumed average lift of 30 metres. The electric energy required to pump 10.5 million hectare metres of water would be 8.75×10^9 kwh corresponding to an installed power capacity of 3,000 mw at a 50 per cent load factor. Approximate estimates of the annual cost involved

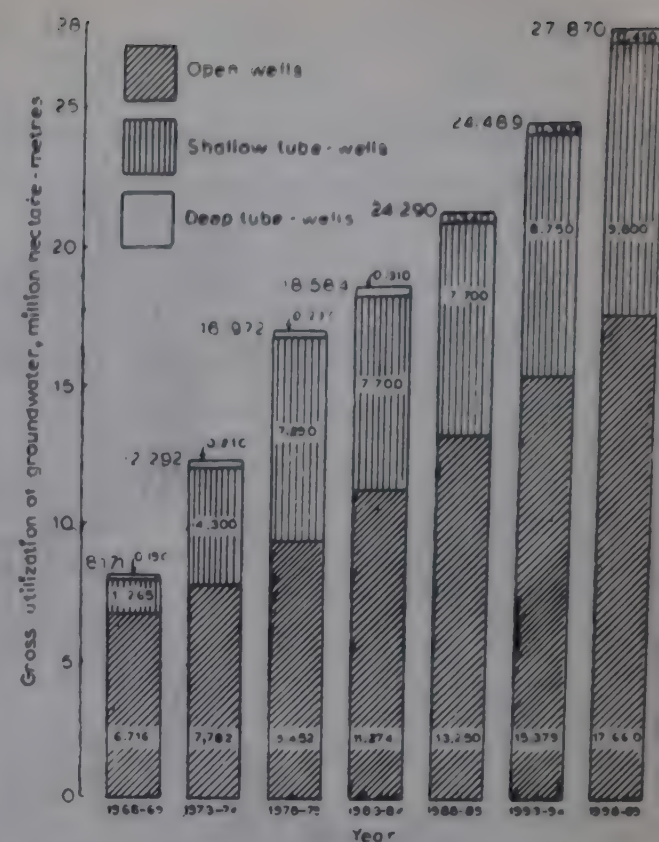


Fig 3. Progressive utilization of groundwater through open wells, shallow tube-wells and deep tube-wells in India

indicate that a cost of about Rs 150 per acre of irrigated area is involved in this scheme. With such a system it is expected that millions of hectares of land can be irrigated with a dependable source of water. Through this study it was observed that the total irrigation potential in the Ganges plains may be limited by the area of irrigable land rather than the water supply.¹ Such are beneficial effects of scientific management of stream aquifer systems in a joint manner.

The particular case study quoted is only a first approximation. This only indicates that there is an unprecedented opportunity for conjunctive utilisation of river aquifer systems. Further, detailed studies of dynamics and economics of the recharge and the operation processes involved must be conducted. Mathematical and economic models of alternative well field configurations, pumping patterns, cropping patterns, irrigation sequences, etc, must be studied in detail before arriving at a final design.

Computer modelling of ground water basins

Electronic computers can play an important role in ground water management. They can be used very effectively by correlating myriads of details from well logs and specific yield, water table data etc. In addition, the development of a mathematical model of the ground water basin on a computer permits the hydrologist to gather more directly and simply a "feeling" of better understanding of the complex interrelationships of the various characteristics of the basin.

The map illustrates the distribution of groundwater basins across India, categorized by their recharge status and the nature of the underlying rocks. The legend defines the following categories:

- Arid and semi-arid zone-groundwater reservoir with limited recharge:** Represented by a pattern of small circles.
- Groundwater reservoirs with scope of recharge:** Represented by a pattern of small squares.
- Groundwater reservoirs with ample scope for recharge:** Represented by a pattern of horizontal lines.
- Groundwater reservoirs with ample scope for recharge along the submountain tracts:** Represented by a pattern of triangles.
- Status of information not enough:** Represented by a pattern of vertical lines.
- Artesian groundwater reservoirs with fairly large scope for recharge:** Represented by a pattern of horizontal lines with dots.
- Coastal groundwater reservoirs:** Represented by a pattern of dots.
- Deltaic groundwater reservoirs under active exploitation:** Represented by a solid black area.
- Groundwater reservoir with fairly closed boundaries:** Represented by a pattern of 'x' marks.
- Groundwater basins in hard and consolidated rocks yet to be precisely delineated:** Represented by a pattern of diagonal lines.

through the process of adjustment and re-evaluation of the transmission and storage characteristics of the ground water basin on the computer, the geologic character of the basin can be delineated with greater assurances and result in a more accurate model of the basin than previously thought possible⁶.

To solve the problems of ground water basin management the hydrology of the surface and ground water of the area must be analysed and understood together with the quality of the surface and ground waters. Detailed data on items related to the hydrologic equation must be compiled and analysed to determine the historical annual surpluses or deficiencies of water and the safe yield and overdraft, if any, of the ground water basin. The historical hydrological information is used to test the mathematical model developed on the computer. One important aspect of the ground water study is the development of the deep percolation characteristics of the surface area within the basin. This information is needed in evaluations of the amounts of natural and applied water that will add to the future water availability in the basin.

With the development of the mathematical model of the ground water basin, the next step is to develop the operational rules. The existing surface water facilities and ground water facilities must be reviewed and grouped to delineate the main storage and transmission facilities in the service area. With this information and knowledge of the characteristics of the basins, the area of study can be divided into units for operational analysis. The future water requirements including peak water delivery demands are then estimated for each operational unit, and the appropriate basin operating rules can be developed.

Conclusions

Based on the discussion so far the following conclusions can be drawn.

1. There is need for more precise estimation of the available potential of ground water resources. Based on the tentative first approximate estimates and the projected trends of demand for water in future, it is obvious that by the year 2000 all the available ground water potential would have been fully developed and still there will be excessive demand for more water.

2. Future ground water management should answer questions like what needs to be done to meet this additional demand, and what should be done for the future after the year 2000?

3. Scientific management of ground water in two broad levels, one on a macro scale, dealing with the modulation of floods, control of evaporation, conjunctive utilisation of stream aquifer systems and, the other on micro scale, dealing with reduction of seepage losses from canals and of on-farm water conveyance losses and improved methods of water applications.

4. The alluvial aquifers such as the Ganga basin where 80 per cent of the flows occur during the short period of the monsoon could be scientifically managed to conserve the water during the monsoon season for use at a later date by regulating the water table in the aquifers.

5. Methods of systems analysis techniques and computer applications to the water resources management systems are the sure means of providing better insight for the problems of ground water management.

References

1. Jain, J. K., *Ground water potential in India*, Souvenir, International Symposium on Development of Ground Water Resources, November 26-29, 1973, Madras, India.
2. Raghava Rao, K. V.; Raju, T. S., and Ramesam, V. *An Estimate of the Ground Water Potential of India — First Approximations*, Soil and Water Management Symposium, Hissar, March 1969.

3. Irrigation Commission, *Report of the Irrigation Commission*, Ministry of Irrigation and Power, Government of India, 1972.

4. Naegamvala, J. P. *Development of Water Resources in India for Irrigation and Hydel Power Generation* — Souvenir, U.N. Seminar on Water Resources Administration, Jan. 22, Feb. 2, 1973, New Delhi, India.

5. Kathpalia, G. N. and Varadan N. S. *Need for a National Water Policy* — Symposium on Integrated Development of Surface and Sub surface Water Resources, CBIP, Nov., 1973.

6. Central Groundwater Board — Displayed Charts.

7. Michael, A. M. Sarma, P. B. S. Sri dharan, C. S. Prasad, J., and Pall, R. *Water Problems in Agriculture With Special Reference to Power Utilisation* — Twelfth FAO Regional Conference, for Asia and Far East, Sept. 1974, Tokyo, Japan.

8. *Report of the Working Group for the Formulation of the Fourth Five Year Plan Proposals on Minor Irrigation and Rural Electrification*, Ministry of Food and Agriculture, Govt. of India, 1968.

9. Planning Commission, *Report of the Task Force on Ground Water Resources*, Planning Commission, Govt. of India.

10. Khosla, A. N., *Analysis and Utilization of Data for the Appraisal of Water Resources* — Journal of the Central Board of Irrigation and Power, October 1949, pp 410.

11. Revelle Roger and Herman T., *Some Possibilities for International Development of the Ganges — Brahmaputra Basin — Tech. Report*, Centre for Population Studies, Harvard University, U.S.A. 1971.

12. Revelle Roger, and Lakshminarayana V., *The Ganges Water Machine* — Science, May 9, 1975. pp 611-616.

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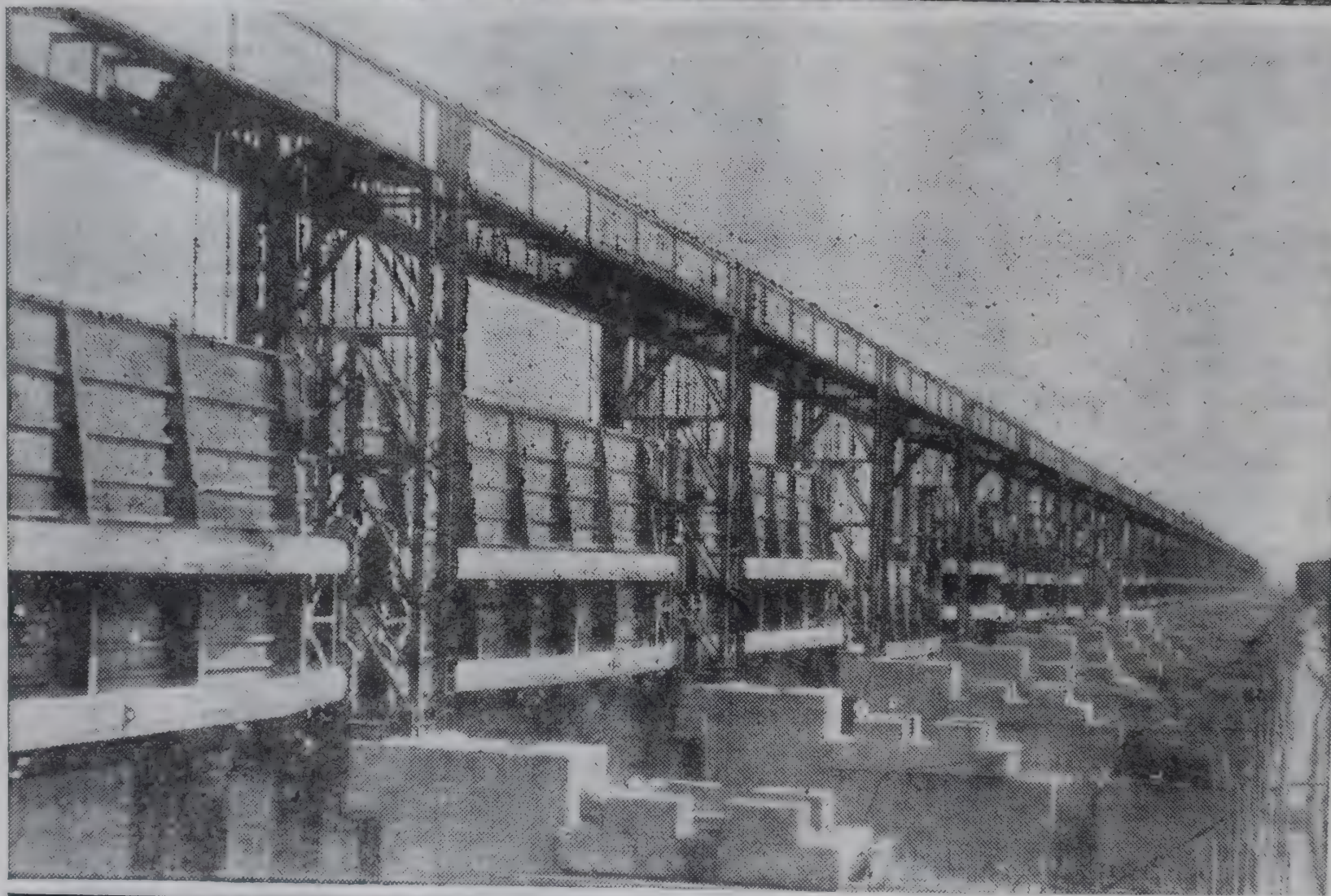
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DESALINATION

WHERE WE STAND

By M. P. S. Ramani

UNTIL about the sixties desalination was promoted by the commercial interests of mainly the United Kingdom, as an appendage to the industrial ventures in West Asia for the exploitation of oil. Acute scarcity of water and availability of cheap oil provided limited motivation for the private sector which would have been otherwise interested only in high profit technologies. The advent of nuclear energy created prospects for the availability of large blocks of comparatively cheap energy. Consequently desalination even in areas not so arid as the deserts of West Asia looked promising. It was envisaged that with the scale-up of reactors to capacities of several thousand megawatts and especially with fast breeder reactors coming into being, energy will be available in abundance at competitive costs. The concept of dual purpose plants made nuclear desalination even more attractive.

The Department of the Interior of the United States of America has been largely responsible for bringing desalination into the limelight in recent years. Five demonstration plants were built under contract from the Office of Saline Water based on the freezing process, vertical tube evaporation, multistage flash distillation, vapour recompression and electrodialysis. Feasibility studies were also conducted for giant dual purpose desalination plants for West Asia and even for the United States. The most notable among them which evoked keen interest and which came close to actual launching of the project was the 1,800 MWe, 5,70,000 M³/day nuclear dual purpose plant for California.

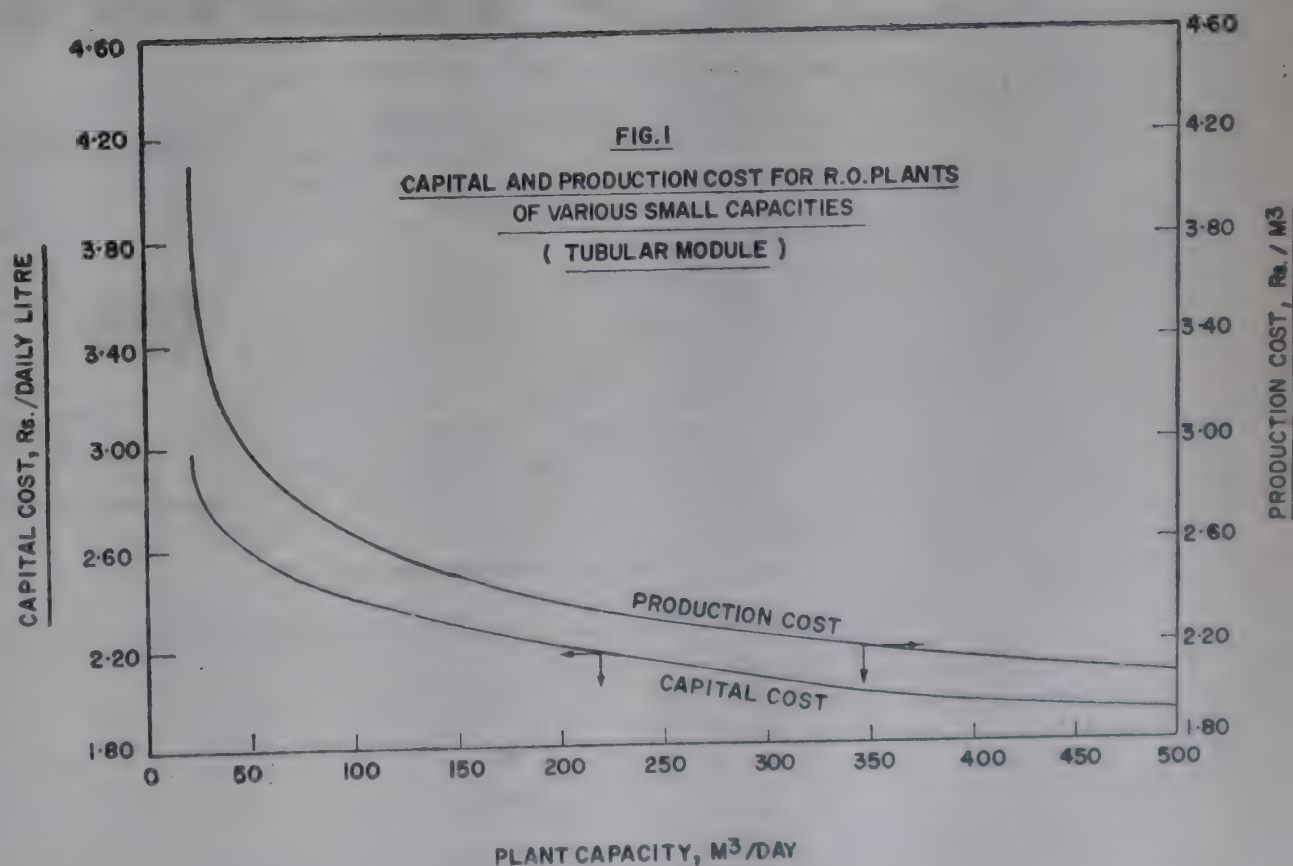
Along with such theoretical studies the technology also progressed, though at a much slower pace. Britain was the pioneer in the field of desalination in

the early sixties. However, the largest single plant built by that country had a capacity of only 6,300 M³/day. The first step in increasing the size of the plants can be said to be the commissioning in 1967 of the 9,300 M³/day plant in Key West, Florida, USA. Since then a number of larger capacity plants have come into existence. Construction of two plants in the 28,000 M³/day capacity range, one at Rosarita Beach in Mexico by Aqua Chem Inc and another by Werkspoor in Netherlands was a step further in the scaling up of capacities. The 18,700 M³/day plant in Jidda was put up in 1971. Two plants of capacities 27,000 M³/day and 61,000 M³/day have also been installed at Abu Dhabi and Shuwaba (Kuwait) respectively. A 1,80,000 M³/day capacity plant is reported to be under construction at present in Hong Kong. All the above are distillation plants for the desalination of sea water. For the desalination of brackish water which contains less salt than sea water one of the membrane processes like reverse osmosis, or electrodialysis

is generally chosen. Tables 1 and 2 list such plants which are at present in operation in the world.

Unlike the profit-oriented technologies there is no self-motivating factor to develop desalination on a large scale in a *laissez faire* economy. If there has been considerable interest in desalination in many countries it is to a good extent to the credit of the Governments in those countries. A slight shift in the image of desalination from that of a mundane science to that of a glamour science has also contributed to this situation.

The processes for desalination are very well understood and the raw material i.e. seawater is available in abundance. Such being the case the sole restraining factor on the development of desalination has been just economics. In order to appreciate and understand the factors that govern the cost of desalted water it is necessary to know certain basic facts.



Mr Ramani is Head of Desalination and Effluent Engineering Division of Bhabha Atomic Research Centre, Bombay.

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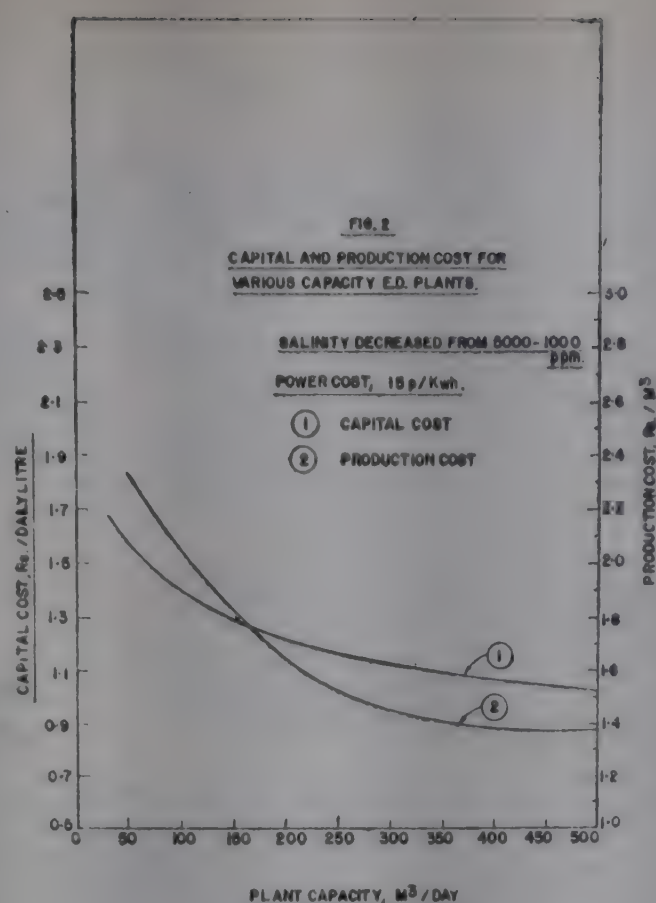
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Desalination is the name given to processes designed to produce fresh water from saline waters. Though the word desalination means removal of salts, rarely this is aimed at in any of the actual processes. As the product of interest is only fresh water and not salt, since even the most saline waters contain more of water than salt and since salt as a solid is difficult to handle, what the desalination processes do is merely to separate a portion of the water from the saline feed. Thus any desalination process can be appropriately presented as:

Saline water less saline water + more saline water
(feed) (product) (reject)

The most well-known and largest source of saline water is the sea which covers almost three-fourths of the surface of the globe. The less known but still quite important sources of saline water are the brackish waters found in inland areas. The seawater on an average contains about 3.7 per cent of total dissolved solids (TDS). The salinity of brackish waters varies widely from a few thousand parts per million (ppm) to as high as 20,000 ppm or sometimes even more. As everyone knows, water of very high salinity is unfit for human consumption. The actual salinity tolerated by the population varies from region to region. The National Bureau of Standards of America has fixed 500 ppm as the upper limit of salinity for potable water.

That desalination is a process which consumes a considerable amount of ener-



gy may be known to everybody. The energy for the process may be required in the form of heat, mechanical energy or electricity. Since in this modern age almost all stationary plants use electric motors for mechanical energy, it can be said that desalination requires energy basically either as heat or as electricity. The form in which energy is required is particularly important. Except in the case of hydro-electric plants we obtain electricity by the conversion of heat energy. Obviously it costs considerably in terms of equipment and operational expenses to convert heat into electricity in a nuclear or a ther-

mal power plant. An even more important factor is that for each unit of heat input in a power plant only about a third or less is converted to electricity and the remaining two-thirds or more are inevitably wasted into the sea, river, lake or atmosphere. It is hardly likely that a technology will be found in the foreseeable future to prevent this waste nor is there any possibility of using this low grade energy for desalination. These facts are to be taken into consideration when we compare energy requirements of different processes for desalination consuming energy in different forms such as heat energy, mechanical energy etc. The desalination processes which are worthwhile for consideration for practical application can be grouped as follows, according to the form of energy input they require:

- A. Processes requiring thermal input:
1. Multistage flash distillation (MSF);
 2. Multieffect evaporation which in

Table 2: Large size electrodialysis plants now operating in the world

Plant location	Capacity (Million lpd)
Buckeye, Arizona, USA	2.46
Brindisi, Italy	5.85
Pentellaria, Italy	1.19
Bengazhi, Libya	22.5
Mash' able Sade (1st phase) ..	2.93
Montecatini, Italy	3.24
USSR	33.75
Kazakastan, USSR	16.88
Webster, South Dakota, USA ..	1.13

modern plants incorporates the vertical tube evaporators (VTE); and 3. A combination of (1) and (2) with emphasis on the latter. This is a new concept and is known as VTE-MSF.

B. Processes requiring electrical or mechanical forms of energy: 1. Reverse osmosis (mechanical energy); 2. Vapour recompression distillation (mechanical energy); 3. Freeze separation (mechanical energy); and 4. Electrodialysis (electrical energy).

The solar still which is not included in the above list belongs to a category by itself.

I am not going into a description of the above processes as they have been

Table 1: Large size reverse osmosis plants presently operating in the world

Plant location	Module	Capacity (Million lpd)	Purpose
Kashima, Japan	Spiral	5.6	For steel industry complex
Ocean Reef, Florida, USA	Spiral	2.5	For drinking purpose
Dallas, Texas, USA	Spiral	1.0	For electronics industry
San Diego, USA	Spiral	0.2	Testing units
Venice, Florida, USA	Nylon hollow fibre	2.0	Drinking
Greenfield, Iowa, USA	Nylon hollow fibre	0.6	Domestic
Haven's Industries, San Diego, USA	Tubular	0.4	Drinking and domestic
Weston Country, Arizona, USA (Under construction)	Mixed	400.0	Water treatment

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dealt with at length in many popular articles before. I will limit myself here to a discussion of the factors which affect the economics of desalination.

A question that has often been raised is, 'What is the minimum amount of energy required to produce a given quantity of fresh water by desalination?' There is no straightforward answer to this question. If only the separative work (i.e. the energy required to separate water from brine) is to be considered the energy requirement could be as low as one could imagine. If only a tiny fraction of fresh water is removed from a large body of brine the separative work requirement per unit of product water will be very small indeed. However in such a case the quantity of feed brine required would become very large. There is, of course, no dearth for brine as our oceans are virtually limitless. However, when the quantity of brine handled increases, the feed treatment costs and pumping power requirements increase almost proportionately and the equipment also becomes uneconomically large. From considerations of optimisation and due to limitations imposed by certain technological problems the separation that is generally practised is of the order of 50 per cent. In other words about 50 per cent of the water from the saline feed is removed as fresh water. A comparison

Table 3 : Energy requirements of various desalination processes

(Per cubic metre of product)

Process	Present Mega calories	Projected Mega calories
MSF	56.0	34.0
VTE	56.0	34.0
VTE-MSF	42.5	—
V.C.	33.7	19.5
Freezing	33.7	19.5
E.D. (Brackish water)	14.0	8.4
R.O. (Brackish water)	14.0	8.4
R.O. (Sea water)	28.0	16.8

of the energy consumption for the various desalination processes is provided in table 3. It is noteworthy that processes requiring mechanical or electrical energy consume much less energy than those requiring thermal energy. Notwithstanding this fact if the thermal

processes are preferred now the reasons are as follows:

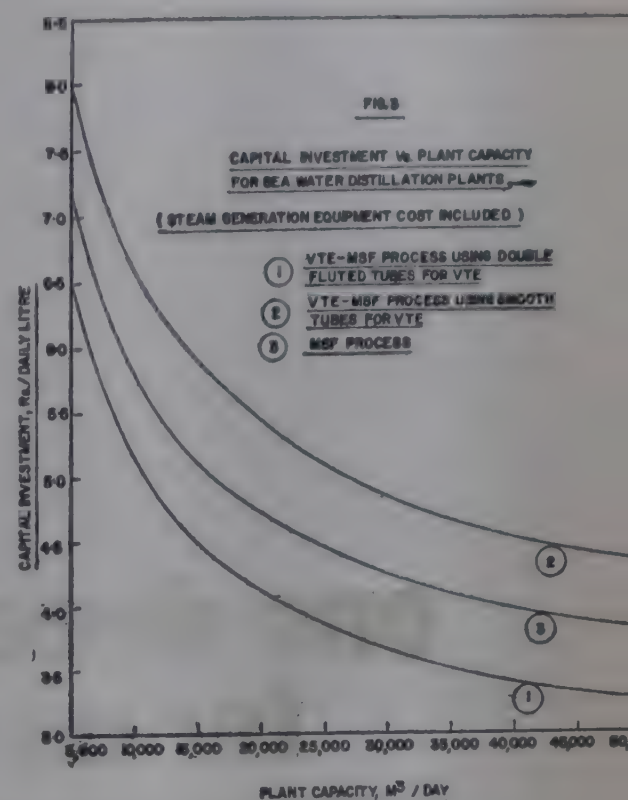
1. Heat energy is simple to produce and utilise. Every housewife knows that a heating equipment, say a gas stove, is cheaper than a cooling equipment, say a refrigerator.
2. Equipment to transfer mechanical energy (high pressure pumps, compressors etc) has moving parts and hence poses many maintenance problems.
3. In the case of distillation processes the quality of product water obtained is much less dependent on feed concentration. Further purity of product as obtained with distillation (including vapour recompression) cannot be achieved in any of the other processes.
4. The concept of dual purpose power-cum-desalination plants is applicable only to the thermal desalination processes.

The last mentioned point needs some elaboration. As stated earlier, mechanical (or electrical) energy is superior to, and hence more expensive than, heat energy. Further heat at higher temperature has a higher potential for conversion to mechanical energy than heat at a lower temperature. For instance the 30 per cent thermodynamic conversion efficiency used in table 3 is achievable only if heat energy is generated at more than 260°C in a power plant. The distillation processes need heat energy only at about 125-130°C. The potential thermodynamic conversion efficiency of heat at 130°C is less than that of heat at 260°C. If a lower thermodynamic efficiency is assumed in presenting the data in table 3 the energy requirements of R.O. and E.D. processes will appear larger.

It will be wasteful to lower the temperature (of say, steam) from 260°C to 130°C without doing any useful work.

In a dual purpose plant this lowering of temperature is achieved in a back pressure turbine thus producing some electricity. The steam at 130°C is used in the desalination plant. Since some electrical energy is also produced as stated above, the net energy requirement for desalination is less than that in a single purpose plant. For instance the net energy requirement for desalination by distillation could be as low as 30,000 K. Cal per cubic metre in a dual purpose plant. Compare this with the figures given in table 3 as also with the latent heat of vapourisation of water which is 534,000 K. Cal per cubic metre.

One disadvantage in any case of distillation desalination is the severe corrosion of the materials of construction



tion due to the higher temperature of operation. The other desalination processes, on the other hand, take place at ambient or below ambient temperatures

The two main components of cost of desalination are energy and capital equipment. Thus far we have discussed the energy requirements of desalination. The capital equipment for desalination is by and large made of copper alloy such as cupronickel and aluminium bronze. Copper, as we know, is an element which is becoming increasingly scarce. Titanium has corrosion resistance properties superior to copper alloy but is at present prohibitively expensive for desalination.

The need and scope for desalination in India were recently looked into by a Working Group appointed by the National Committee for Science and Technology.* According to the findings of the Working Group the demand for desalination could be broadly categorised as follows:

1. The need for water for domestic as well as industrial purposes in medium sized and large cities: Such demand would be fairly large ranging from about 5,000 cubic metres per day to as high as 500,000 cubic metres per day. If such large demands have to be essentially met by desalination of sea water

* Report of the NCST Working Group on Research and Development Programme For Sea Water and Brackish Water Desalination Government of India, Department of Science & Technology, New Delhi, May, 1975

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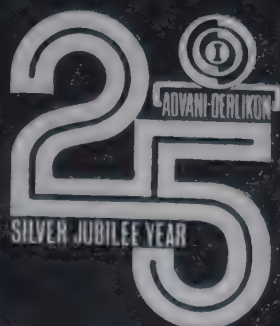


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only one of the distillation processes could be feasible at present.

2. *The need of several thousand villages where only brackish water is available at present:* The overall requirement in this category is over a million cubic metres per day. However the requirements of individual villages would range from 50 to 500 cubic metres per day only. In consideration of the general welfare of our rural population this is an urgent need that requires the attention of agencies and organisations concerned with supply of water. The membrane processes, particularly reverse osmosis, will be most suitable for this purpose. Reverse osmosis and electrodialysis plants can be built in small package units and they are suitable for desalting brackish waters containing 5,000 to 10,000 ppm total dissolved solids.

The small cities of Gujarat such as Jamnagar and Kandla face acute scarcity of water. Distillation plants of the order of 5,000 to 10,000 cubic metres per day could meet their requirements.

The city of Bombay is well endowed with natural resources of water. However, due to the high population and industrialisation there is a shortage of water which is of the order of 1,300,000 cubic metres per day. Nevertheless it is necessary to explore other sources before any decision to build desalination plants is taken.

As everyone knows the city of Madras faced an unprecedentedly acute scarcity of water during the summer months this year (1975). During normal times Madras city faces a shortfall in supply to the extent of 200,000 M³/day. Even with the implementation of all the projected programmes for the supply of water the shortfall will continue for decades to come. It may be worthwhile to consider desalination to meet the shortfall, if not immediately, at least a few years hence. A desalination plant will stand in good stead in times of distress during drought years.

The study of the Working Group has identified water salinity problems in so many towns and several hundred villages in Tamil Nadu, Kerala, Gujarat, Andhra Pradesh, Karnataka, Rajasthan, and West Bengal.

Besides the need for water for drinking and industrial purposes a few special types of need for desalination plants have been identified. Ocean-going vessels depend on compact ship-

borne desalination plants for their water supply. Merchant as well as naval ships built in our shipyards are equipped with imported desalting plants. As the life of a ship is much longer than that of a desalting plant such plants are needed for replacements also. If these units could be made indigenously it would result in the saving of foreign exchange to that extent.

There is need for small mobile desalination plants to meet the needs of our defence forces.

With our increasing industrial relations with West Asia many Indian companies are entering into collaboration to put up steel, fertiliser and thermal power plants. Mostly these industrial ventures require also desalination plants for their water supply. Thus there is vast scope of export of plant as well as knowhow. Supply of desalination plants also helps to keep up our technological image and it is good salesmanship.

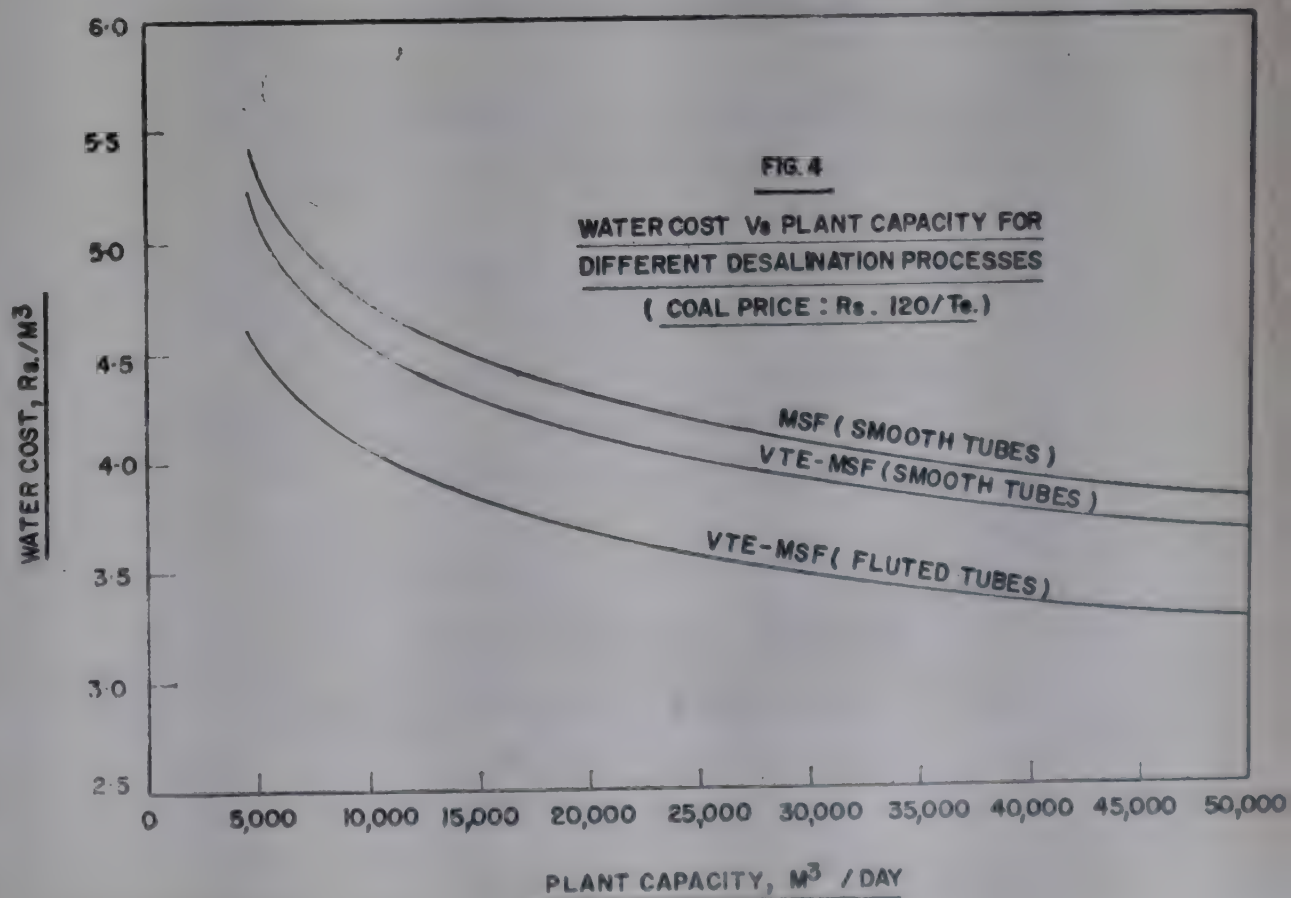
The cost element

Notwithstanding all technological developments, the ultimate deciding factor in the matter of desalination is cost. Water is a prime necessity for existence and hence should be made available at tariff levels which even the poorest sections of society can afford. In the city of Bombay water supplied for domestic use is charged at Re 0.25 per cubic metre. The tariff rate for the industries is Re 0.80 per cubic metre and for shipping by private firms it is as high as Rs 1.40 per cubic metre.

The tariff rates in the city of Madras range from Re 0.50 per cubic metre for domestic use to Rs 2.00 per cubic metre for industries. The two important factors to be considered in fixing tariff rates for water are: (1) Water is a prime social need, and (2) wasteful use of water should be discouraged particularly where it is scarce. Being a prime social need water supply becomes the responsibility of governments and local authorities. The usual norms of economic viability as applied to commercial ventures cannot be applied straightaway to water supply schemes. In fact if necessary water supplies may even have to be subsidised for such purpose as domestic use by charging higher tariff on consumers, such as industries, who can afford.

It would be pertinent here to examine the cost of desalination and how far it is economically feasible for adoption.

As stated already the membrane processes, particularly reverse osmosis and electrodialysis, are suitable for the desalination of brackish waters. Small package units of 50 to 500 cubic metres per day could be used for water supply to villages. A reverse osmosis plant of 50 cubic metres per day capacity is expected to cost about Rs 1.2 lakhs and the water from such a plant would cost about Rs 3.00 per cubic metre including interest on, and amortisation of, capital investment. These costs are quite high compared to the paying capacity of the villagers. However for restricted supply for essential purposes like drinking and cooking these are within limits



that can be supported by subsidies. With further research and development on advanced concepts like hollow fibres it can be reasonably expected that costs could be brought down to much lower levels. Some typical plots of cost and capacity for reverse osmosis and electro-dialysis plants with present-day technology are given in figures 1 and 2 respectively.

It has been stated that to meet the water needs of medium sized and large cities, distillation plants are the most appropriate. Figures 3 and 4 give data on capital investments and water costs respectively for such plants. The capital cost of a 50,000 cubic metres per day plant could vary from Rs 23 crores down to Rs 16 crores with advancement of technology. The corresponding water costs could vary between Rs 3.80 and Rs 3.25 per cubic metre at a coal price of Rs 120 per tonne. These costs are arrived at assuming a 9 per cent interest rate which is quite reasonable for a utility (category 4) system.

The above costs are for coal-fired single purpose plants. Estimates made for a nuclear dual purpose plant with a 650 MWt heavy water reactor (which is of the type and size of reactors built at Rajasthan and Tamil Nadu and being

planned for Narora in UP) give the following cost figures.

Reactor type	..	Pressurised Heavy Water reactor
Desalination plant	..	VTE — MSF
Reactor rating	..	650 MWt.
Net saleable power	..	94 MWe
Water production	..	280,000 M ³ /day
Capital Investments		
Nuclear power plant	..	Rs. 132 crores
Desalination plant	..	Rs. 46 crores
Water production cost	..	Rs. 1.87/M ³ .

If water distribution costs are also added, the cost at the consumers' end may work out to Rs 2.00 per cubic metre which is equal to the tariff charged to industries in Madras city and four times what is charged for domestic use.

Where differential tariff systems are prevailing a nuclear desalination plant supplementing water from conventional sources is not likely to add to the burden

of the tax payer as, in such a case, the higher cost of desalted water can be converted by the higher tariff charged to certain specific types of consumers. On the other hand, desalination plants serving as base load stations, can come to the rescue in the event of a drought when conventional sources fail, as happened in the city of Madras last summer.

It has been reported that in Madras during the drought months this year water was being supplied at Rs 300 per tanker of 10,000 litres. This works out to Rs 30 per cubic metre. The amount spent on drought relief work during the same period was Rs 2 crores. It may be interesting to compare these figures with the costs of desalination presented above.

Research

An experimental VTE plant is in operation at the Bhabha Atomic Research Centre (BARC) and it has provided valuable data, knowhow and experience necessary for building large plants. An MSF pilot plant is under construction and is scheduled to be commissioned in a few months. A ship-borne desalination plant designed in BARC and now under fabrication is to be test-run in a ship.

Research and development work on tubular reverse osmosis membranes and hollow fibres is also in progress.

BARC has provided consultancy service for several Indian firms intending to put up desalination plants in countries in West Asia.

But for a small desalination plant linked to a fast reactor in Shevchenko on the Caspian Sea coast in the USSR, no nuclear dual purpose plant has as yet been built. Nevertheless nuclear power and large scale desalination are inextricably linked.

In nuclear technology we have hardly touched the fringe. In the years to come the development of fast reactor technology will not only reduce cost of energy but will also open for exploitation our vast reserves of thorium. If desalination technology should complement in such a situation research should be vigorously pursued even from now. A 200,000 or 500,000 M³/day desalination plant poses a considerable challenge and it takes years to develop the necessary experience and expertise to design and construct such a plant.

The energy values given for VC, freezing, ED and RO processes are the thermal energy inputs necessary for the appropriate electrical power generation at 30 per cent plant efficiency.

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Solar energy for desalination

By S. D. Gomkale

SOLAR energy can be used for desalting of saline water. A number of different designs have been developed. Due to the diffuse and intermittent nature of solar energy, simple glass-covered greenhouse-type solar stills are found to be particularly suitable for desalting saline water. Suitability of solar energy for desalination in the country is discussed on the basis of work carried out in the Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar.

Natural precipitation i.e. rainfall, is the result of a water cycle (a natural desalting plant) generated by the sun's energy. In spite of the tremendous quantity of fresh water supplied by precipitation on earth, the need for desalination of sea or saline water is felt due to the uneven distribution of rainfall and large-scale use of water in many regions. This need has resulted in developing different techniques of desalination. It is no wonder that reproduction of the water cycle, which is nothing but an operation of simultaneous evaporation and condensation or distillation on a small scale, with the sun as the source of energy, was one of the first efforts in that direction.

Solar energy has been used for various distillation processes (e.g., for obtaining perfumes and medicines from flowers, herbs, grasses etc.) since ancient time. In 1742, Nicolo Ghezzi suggested a number of proposals including one for using solar heat for distillation. This can be considered the first specific reference to the use of solar energy for obtaining fresh water. In the earlier years of development the French workers carried out a lot of work due to their interest in supplying fresh water to colonial troops in French-occupied

desert regions of North Africa. The USSR and the USA also did some work. But the real impetus to the work on solar distillation in recent years came with Second World War, and systematic studies were started in many countries. The world's first solar energy-operated large capacity plant was designed and constructed in 1872 at Las Salinas in Chile by a Swedish engineer, Charles Wilson. This plant had an evaporating water surface area of 4460 m², and it was in use for about 40 years.

It is seen that in all the developmental work more concentration has

been on using solar energy for distilling saline water in simple glass or plastic covered stills. In addition to this, solar energy was also used in the USSR¹ to generate steam which, in turn, runs the multi-effect desalting plant. The scheme to operate a multi-stage flash distillation plant with solar energy² has also been proposed. These proposals are not suitable due to availability of solar energy only during the daytime and additional power being required for running pumps etc. In the following discussions only simple solar stills are dealt with.

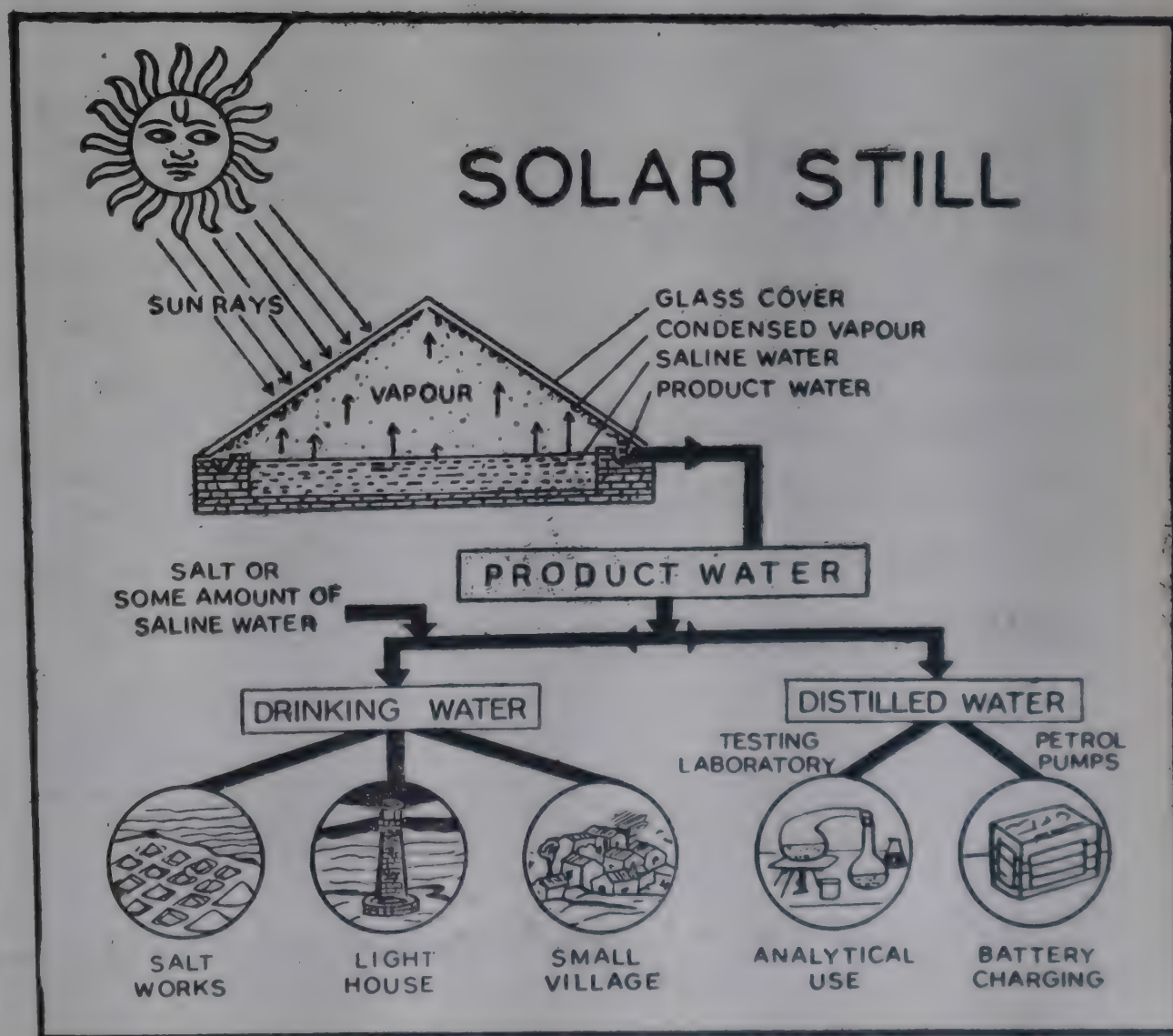
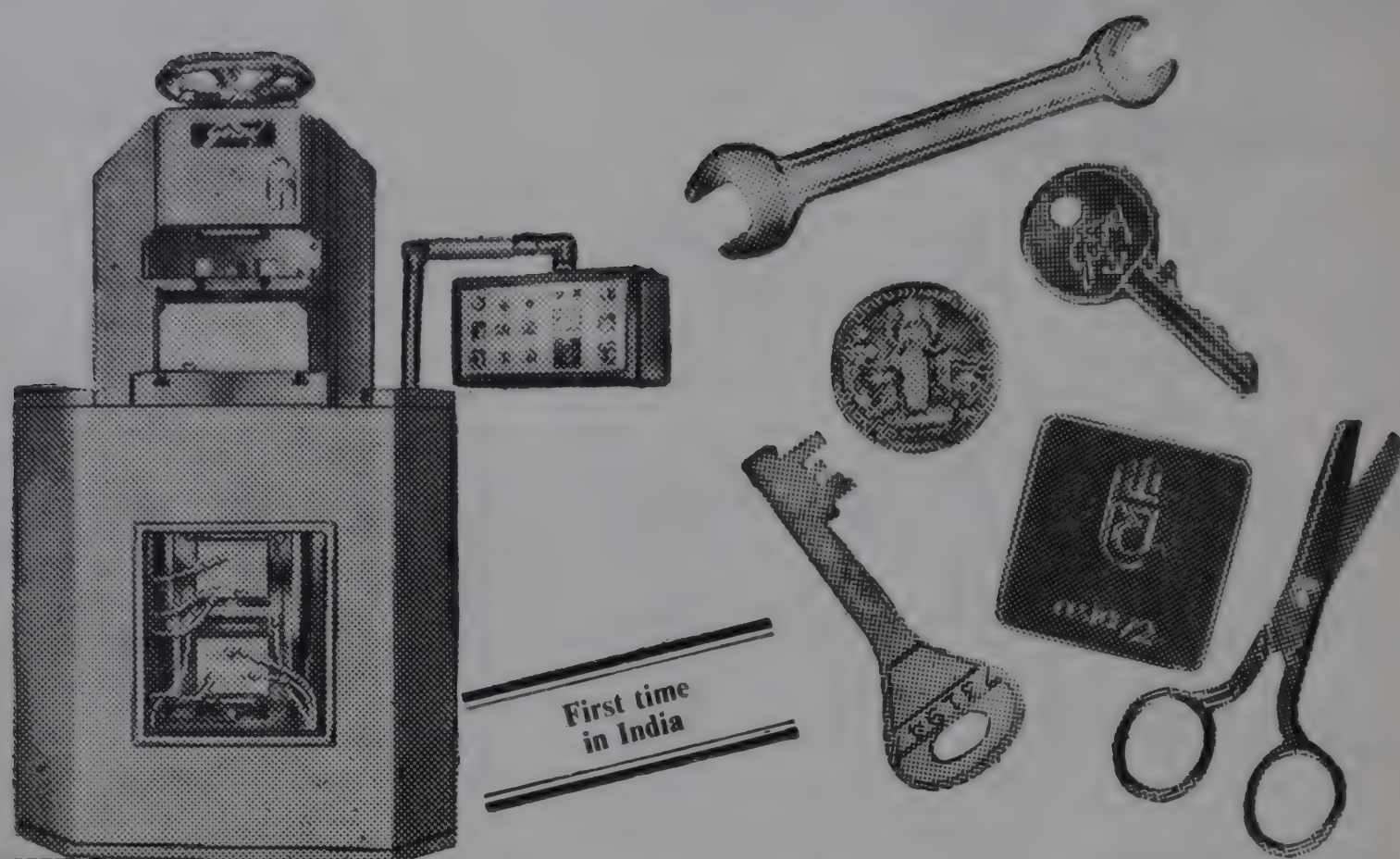


FIG. 1. PRINCIPLE AND APPLICATIONS OF SOLAR STILL

Dr Gomkale is Scientist attached to Central Salt and Marine Chemical Research Institute, Bhavnagar.



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Desalination with solar energy

The working principle of a solar still is shown in Fig 1, and the various developments and the forms of solar stills experimented with are shown in Fig. 2. It will be seen that the solar still distils saline water inside it without any moving part, and the output per unit area depends on the solar energy input. The sun's energy falling on the evaporating surface of saline water is not completely used for distilling, but is lost in more than one way, namely, by reflection, convection and radiation from glass covers and through conduction from sides and bottom. It is obvious that all the evaporated water vapour must be condensed and recovered without much loss through leakage of vapour and condensate. Due to these losses and the diffuse and intermittent nature of solar energy, the output per unit area is quite low and it varies depending on season. The maximum attainable efficiency of utilisation of solar energy in a well designed and thermally insulated still^a is expected to be around 60 per cent, whereas all operating installations show it to be around 25 to 30 per cent.

The solar stills can be characterised as simple to construct, operate and maintain with the minimum of operational cost due to absence of moving parts and freely available solar energy as fuel. They are further characterised by a high initial investment and lower operating costs. Due to lower output per unit area, the desalted water cost is high and individual plant capacity is also less. But with the modular type of construction (as the size of an individual still is fixed, i.e. length and width) the capacity of the installation is easy to increase. The developmental work is more concentrated on reduction in the investment cost by using suitable materials for various components as listed in Table 1. With the characteristics discussed above it is very easy to conclude that desalination by solar energy is feasible or suitable in areas having abundant solar energy and saline water and where water requirements are very small and no other source of energy is available, i.e. mainly in arid and semi-arid regions of the world. In Table 2 some of the existing solar distillation plants are listed.

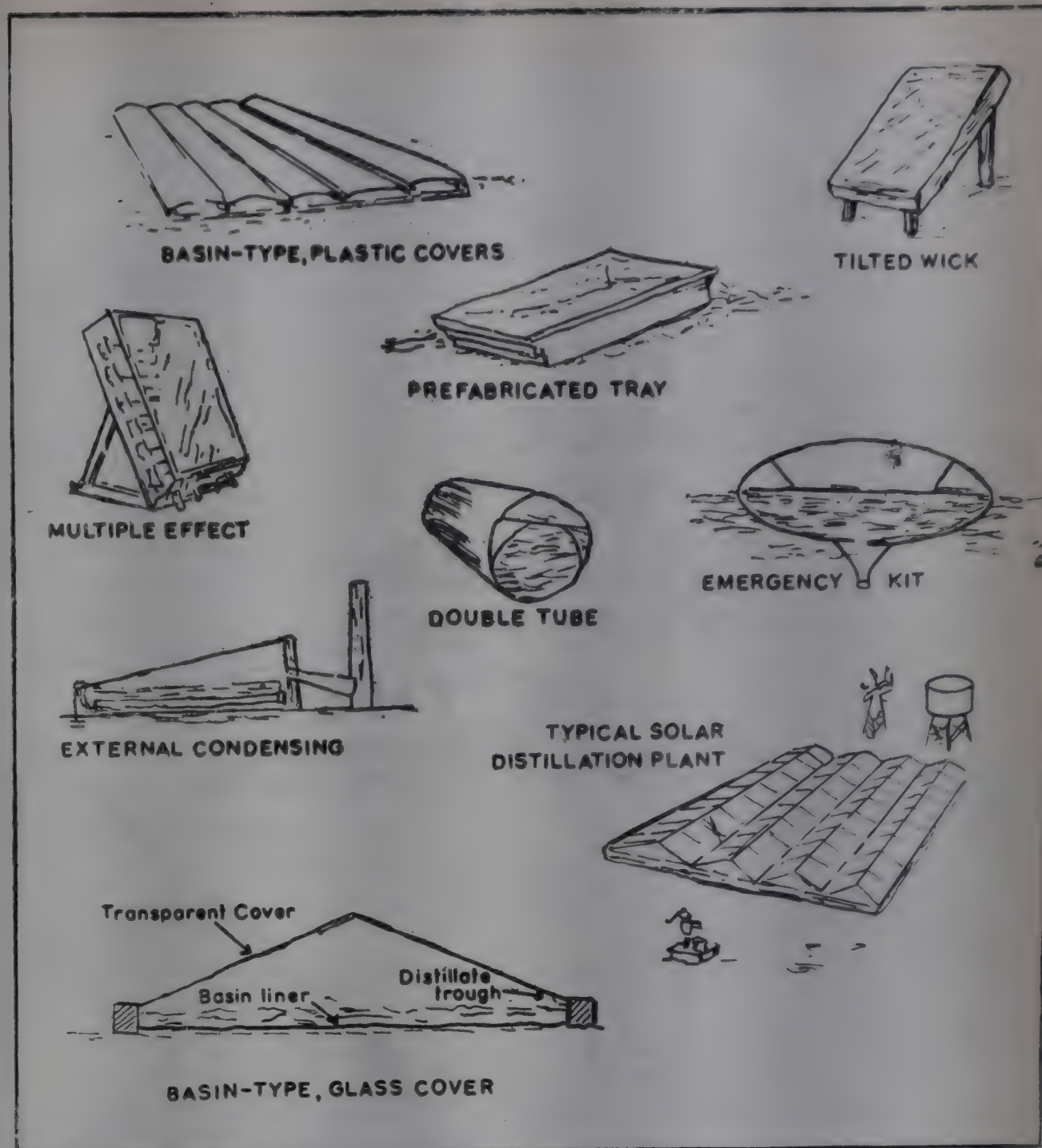


FIG. 2. TYPES OF SOLAR STILLS INVESTIGATED IN DIFFERENT COUNTRIES

Table 1 : Materials of construction for solar distillation plants

Component	Materials
Basin liner	Butyl rubber*, asphalt mats, black polythene†, roofing asphalt (over concrete etc.) cement concrete*
Cover	Window glass*, wettable Tedlar plastic†
Distillate trough	Stainless steel, butyl rubber (lining), polyethylen† (lining), aluminium*
Support structure	Concrete, concrete blocks, aluminium, galvanised metal, redwood, seasoned wood
Sealant	Silicone rubber*, asphalt caulking compounds*, butyl rubber extrusions
Piping and valves	Polyvinyl chloride*, asbestos cement, acrylonitrile butadiene styrene
Water storage reservoirs ..	Concrete, masonry

* Commonly used materials.

† Relatively short life.

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Table 2 : Some of the large operating solar distillation plants

Country	Location	Area covered m ²	Reported or estimated capacity litres/day
Australia	Cooper Pedy	3160	6350
	Hamelin Pool	558	1210
Greece	Symi*	2690	7560
	Patmos	8650	22300
	Kimolos	2510	7560
	Nisyros	2040	6050
	Las Marinas	870	2370
Tunisia	Mahdia	1300	4160
U.S.S.R.	Bakharden, Turkmenia	600	1625
West Indies	Petit St. Vincent	1710	4920

* The plant has facilities for preheating saline water with waste heat. Almost all plants have glass as cover material.

The earliest work on solar distillation was carried out at National Physical Laboratory (NPL), New Delhi, and later the Defence Laboratory, Jodhpur, also did some work. But extensive work on the laboratory and pilot plant has been carried out at the Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar, on solar stills. These studies have resulted in definite conclusions regarding suitability of solar stills in the country⁴.

The laboratory studies helped in understanding the heat and mass trans-

fer operations and the effect of various variables on productivity expressed as litres/m² x day. These observations were confirmed on pilot plant (1,000 lit/day capacity having ten stills with varying depths and cover angles) which additionally helped in understanding various operational and maintenance difficulties and resulted in selecting suitable materials of construction. It was also confirmed that by slight modifications in construction, rainwater falling on clean glass covers can also be

collected, and thus the solar stills function as distillers-cum-rainwater collectors. The product water, apart from its use to supply drinking water, is also a good source of distilled water, and this use has resulted in developing solar stills with semi-permanent construction using black plastic film as basin liner, whereas in permanent constructions, complete cement construction is suitable due to non-availability of commonly used butyl rubber in the country. Bitumen based sealants are substituted for silicone as a sealant for various joints.

The suitability of solar stills for supply of drinking water in the country



Fig. 4. Solar stills installed at Navihar lighthouse (near Jamnagar) to supply drinking water, capacity 130 litres/day.

was thoroughly studied, and it is seen that it is quite suitable to meet small-scale water requirements of isolated communities (See Fig. 1). Figures 3, 4, 5 and 6 show the pilot plant, an installation at the Navinar lighthouse for supply of drinking water, a small semi-permanent solar still for supply of dis-

Fig. 3. Pilot plant of solar stills installed in the salt farm of CSMCRI, capacity 1,000 litres/day.



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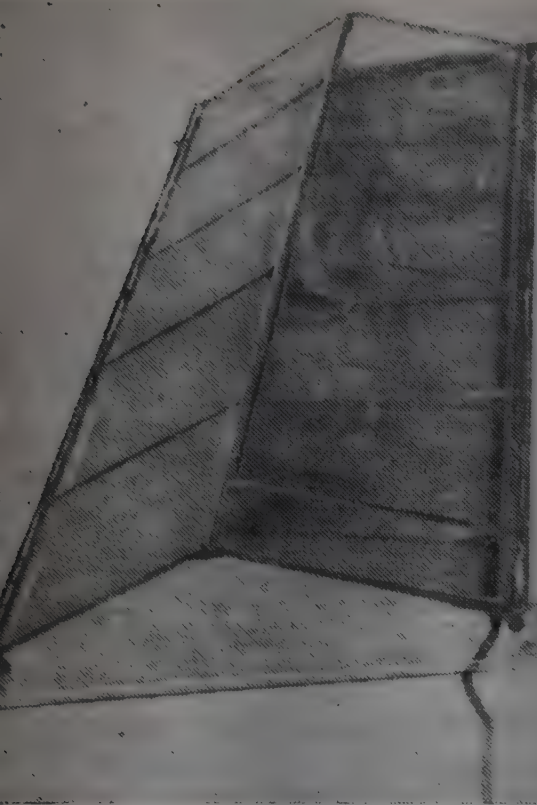


Fig. 5. Small semi-permanent unit to supply distilled water, capacity 7 litres/day.

led water (similar units can be used as a family unit for drinking water) and the solar stills recently constructed in the garages in CSMCRI supplying 100 litres/day of distilled water respectively.

As mentioned earlier, solar desalting is a capital-intensive process. The initial investment in solar stills constructed, using civil engineering materials and glass covers, is around Rs 100 to 120 per sq m which, depending on the location (i.e. availability of solar energy) will produce two to three litres per day on an annual average. These facts result in high cost of product water (about Rs 10 per m³), and this cost is not much affected by increasing capacities due to modular constructions involved. More than 70 per cent of the cost of product water is contributed by depreciation and interest charges (a situation for subsidy). The cost of desalted water was compared with the cost of water transported by pipeline. These studies have shown that the solar still installation of a capacity between 5,000 and 10,000 litres/day can be considered as an optimum installation capacity.

Conclusions

India is a tropical country, and a major part of it comes under arid and

semi-arid regions. The most arid regions in Rajasthan, Gujarat and parts of Haryana and Punjab are severely hit by water scarcity and, due to scarce population and lack of other sources of energy, solar energy can be best utilised to desalt the available saline water to quench the thirst. Desalted water produced using solar energy is costly, but under the worst conditions it is the need and not the cost of water which gains priority, and the cost of water should be compared with the cost of water paid at sites in deserts (water transported in tankers even over a distance of 10 km cost more than Rs 10 per m³) and not with what is paid by a privileged urban population. If viewed from a correct perspective it is felt that solar energy can be fruitfully used for desalination in desert regions of India.

Acknowledgement

Author expresses his sincere thanks to Dr D. J. Mehta, Scientist-in-Charge for his guidance during the preparation of this paper.



Fig. 6. Permanent solar stills constructed on garages at CSMCRI to supply distilled water, capacity 100 litres/day.

References

- 1 V. A. Baum, *Solar distillers*, Proceedings of U.N. Conference on New Sources of Energy, Rome (1961).
- 2 H. Weihe, *Fresh water from sea water—distilling by solar energy*, Solar Energy 13 (4) (1972) 439.
- 3 P. I. Cooper, *The maximum efficiency of a single-effect solar stills*, Solar Energy 15 (3) (1973) 205.
- 4 Report of the work on solar distillation carried out at CSMCRI, Bhavnagar.

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VERSE OSMOSIS

Relevance to India for Desalination of water

y D. J. Mehta

THE potable water supply system can be created in a variety of ways. These include construction of large reservoirs, underground storage facilities, long-distance transportation by pipelines and setting up of desalination plants using distillation and membrane techniques. Some of these methods require a large capital investment, and hence it is rather difficult for our country to go in for such capital-intensive systems in the near future. The adoption of the reverse osmosis process, one of the membrane-processes of desalination, can help convert locally available brackish water into fresh water. In several water shortage areas of Gujarat, Rajasthan, Bihar, Orissa, Karnataka and Punjab, sufficient quantities of brackish water are available at reasonable depths. The total number of villages and population covered in these regions are presented in the accompanying table.

In some parts of these States, villagers do not get quality water, and they entirely depend for their day-to-day requirements of water on the available pockets of brackish water which, no doubt, affects their health. A solution to this problem could be achieved through setting up several reverse osmosis plants in villages where

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people at present use brackish water for cooking and drinking.

'Osmosis' is the spontaneous flow of solvent from diluted to concentrated solutions when they are separated by a semi-permeable membrane. The spontaneous flow of solvent through membrane is due to the effective driving force caused at the inner face of the membrane called osmotic pressure. The magnitude of the osmotic pressure depends on the concentration of the salt solution and the temperature of the water. By creating pressure on the salt solution, the process of osmosis can be reversed. When the pressure on the salt solution side is greater than the osmotic pressure, fresh water diffuses through the osmotic membrane in the opposite direction to the normal osmotic flow. The process is purely mechanical, and there is no phase change; it can be operated at ambient temperature; there is low energy consumption compared to other desalina-

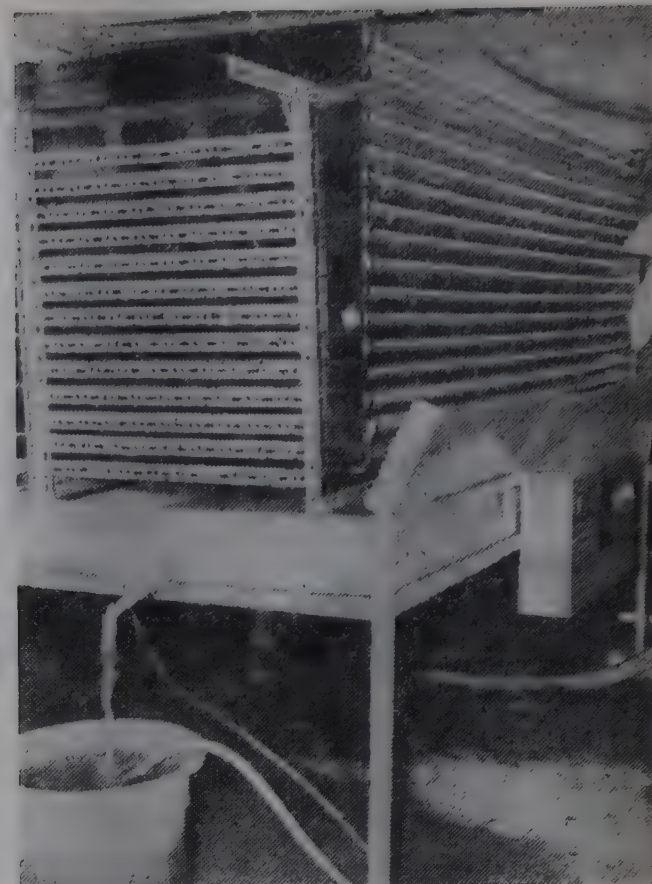


Fig. 1. Reverse osmosis plant.

tion processes; there is no scale or corrosion problem; there is little sensitivity to change in brackish water salinity; and the process also removes bacteria and viruses from feed waters. In short, reverse osmosis is comparatively simple to adopt and to operate and has the additional advantages of inherent flexibility in both end use and plant extension capability. Attracted by these above-mentioned advantages, the Institute undertook investigations on the development of a reverse osmosis plant and is the pioneer in this country in setting it up in a most reasonable time.

The heart of the reverse osmosis process is the membrane. The Institute has developed and mastered a technique for casting a flat and tubular membrane from cellulose acetate using formamide as additive and acetone as solvent. The water flux properties of the membrane are 10-15 gallons/sq ft a day and up to 90-95 per cent salt rejection in pro-

Number of villages with population up to 499, 500-999, 1000-1999, 2000-4999

Name of the State	Population up to 499	Population 500 to 999	Population 1000 to 1999	Population 2000 to 4999
Gujarat	8,504	5,299	3,301	662
Rajasthan	21,612	6,596	2,936	1,003
Bihar	42,422	13,784	7,635	1,332
Orissa	36,151	7,334	2,573	452
Karnataka	14,569	6,481	3,723	1,432
Punjab	6,093	3,221	1,940	648

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ing, on an average, 5,000 ppm TDS per. Out of two approaches for developing reverse osmosis plants viz. plate and tubular, the Institute has found it suitable to build reverse osmosis plants based on tubular configuration. The plant consists of perforated anodised aluminium tubes, 2.5 metres in length with 19.5 mm inside diameter in which the tubular cast and pre-treated cellulose acetate membrane supported by nylon cloth is inserted and mechanically sealed. These tubes are then assembled in a series by means of specially designed headers. The fitted assembly is called a module. A number of such modules can be assembled one over the other, depending on the capacity of the plant to provide the required quantity of fresh water. The other equipment required in the plant comprises high pressure pump, transfer pump, booster pump, back-pressure regulating valve, needle valves, rotameters, etc. The equipment is indigenously made. The operating experience of a reverse osmosis plant has shown that maintenance and supervision costs are less, and it is more economical than other desalination processes. It has also the additional advantages in that it can be used on a small scale with little increase in the cost of product water, and the plant can be operated for processing brackish water having 2,000 to 10,000 ppm TDS in one pass. The conversion of brackish water into potable water by CSMCRI reverse osmosis system is shown in Table 1.

More than 90 per cent of salt can be rejected through CSMCRI reverse osmosis system and can easily be adopted even in villages, where electricity

is not available, by driving the system by means of a self-generating power unit. Further research in the Institute is expected to improve plant economics in the near future, so that the system can also be adopted in agriculture.

The economics of the plant, as based on the knowledge and experience gained during the development of the reverse osmosis technique in this Institute, is presented in Table 2. The data are applicable up to 1974 and further development is likely to improve its economics.

Reverse osmosis, as developed in the Institute, has not only been found useful for desalination of brackish water but also for several industrial applications such as: (i) fruit juice concentration; (ii) separation of proteins and lactose from cheese whey; (iii) enzyme concentration; (iv) by-product recovery from industrial waste; (v) fresh water reclamation from polluted sources; (vi) separation of sodium chloride from iron dextran solution.

The progress so far made in this direction in the Institute is briefly described in the following paragraphs.

(a) *Concentration of sodium sulphate from rayon industry effluent:* Exploratory investigations have shown that reverse osmosis could be used with advantage for the concentration of sodium sulphate from 1-2 per cent originally present in the rayon industry effluent to nearly 12-15 per cent. This concentrated effluent, after treatment by active carbon for the removal of colour, could be re-used by the industry, or sodium sulphate could be recovered from this by either evaporation or chilling.



Fig. 2. Reverse osmosis plant which earned the gratitude of the people of Rajasthali, a village of Amreli district, Gujarat.

(b) *Fractionation of cheese whey into proteins and lactose:* Cheese whey is a waste disposal of the dairy industry. This contains valuable proteins and lactose which have nutritive value. Preliminary experiments conducted on the Amul Dairy cheese whey have shown that by the combined technique of ultrafiltration/and reverse osmosis, proteins could be concentrated to nearly five times while the lactose concentration was 3-4 fold. The overall recovery of proteins and lactose in their respective 'concentrates' was 70 and 80 per cent respectively. These concentrated fractions can be spray-dried to get the solids.

Locations for reverse osmosis plants

(c) *Removal of BOD from pulp mill effluent:* The pulp mill effluent, supplied by the Central Pulp Mills, Fort Songad, Surat, was treated for the BOD removal by reverse osmosis. The permeate from the process was found to contain less than 10 ppm BOD as against 200 ppm originally present in the effluent. Thus, the permeate from a reverse osmosis plant can be re-used in the factory, or can be disposed of into inland streams.

(d) *Sewage treatment:* Studies in the laboratory have shown that sewage, after the necessary pre-treatment, can be treated by reverse osmosis, and the permeate passing through the reverse osmosis membranes is found to be fit for re-use.

Large quantities of saline waters are available in the coastal regions of

Table 1 : Desalination of brackish water with E-398-10 membrane

Feed (ppm)	Sample	Ion (ppm)				
		Ca ⁺⁺	Mg ⁺⁺	Na ⁺	Cl ⁻	SO ₄ ⁼⁼
About 2,500	Feed	64	106	650	1207	296
	Product water	5	6	48	94	Nil
	Per cent Rejection	92.2	94.3	92.6	92.4	100
About 5,000	Feed	86	191	1315	2385	477
	Product water	5	6	76	135	Nil
	Per cent Rejection	94.0	96.9	94.3	94.3	100
About 7,500	Feed	92	291	2127	3877	566
	Product water	8	18	272	383	Nil
	Per cent Rejection	91.3	93.8	87.2	90.1	100

Table 2 : Cost estimation for different capacity desalination plants by reverse osmosis technique

	Plant capacity : Litres/day			
	20,000	50,000	1,00,000	2,00,000
	Rs	Rs	Rs	Rs
Capital cost (Rs/1000 litres)	2,400	2,100	1,900	1,700
Capital cost (Rs/1000 gals)	10,800	9,400	8,700	7,600
Product water cost (Rs/1000 litres) ..	1.93	1.87	1.77	1.79
Product water cost (Rs/1000 gals) ..	8.7	8.5	7.9	7.6

Gujarat, and some brackish water pockets are available in the inland areas of Rajasthan. Fresh water needed for the economic development of these areas can be provided by reverse osmosis conversion of the available saline waters, and potable water especially for drinking and cooking purposes can be supplied to these people. The islands near the Ernakulam outlet in Kerala suffer from an acute water shortage. Lack of fresh water has hindered the economic development of these islands. These islands can also

attract tourists in view of their historical and cultural importance. A good source of water supply of about 2,000 ppm water is available, and this can be processed by reverse osmosis to yield fresh water so as to change the face of these islands. In brief, in most of the water shortage areas, there are ample supplies of ground brackish water. By the use of CSMCRI reverse osmosis system, the brackish water can be readily converted into fresh water supplies of potable quality. The entire system is such that it can easily be adopted

in our country. The only solution for immediate, implementation is to delegate responsibility to local water management departments in each State and put before them a definite goal and a time-bound programme so that the villagers can get their requirement of quality water. Our experiment at Rajasthali, a drought-affected village of Amreli district in Gujarat (Fig. 2) has been successful and this only encourages us to work in this direction.

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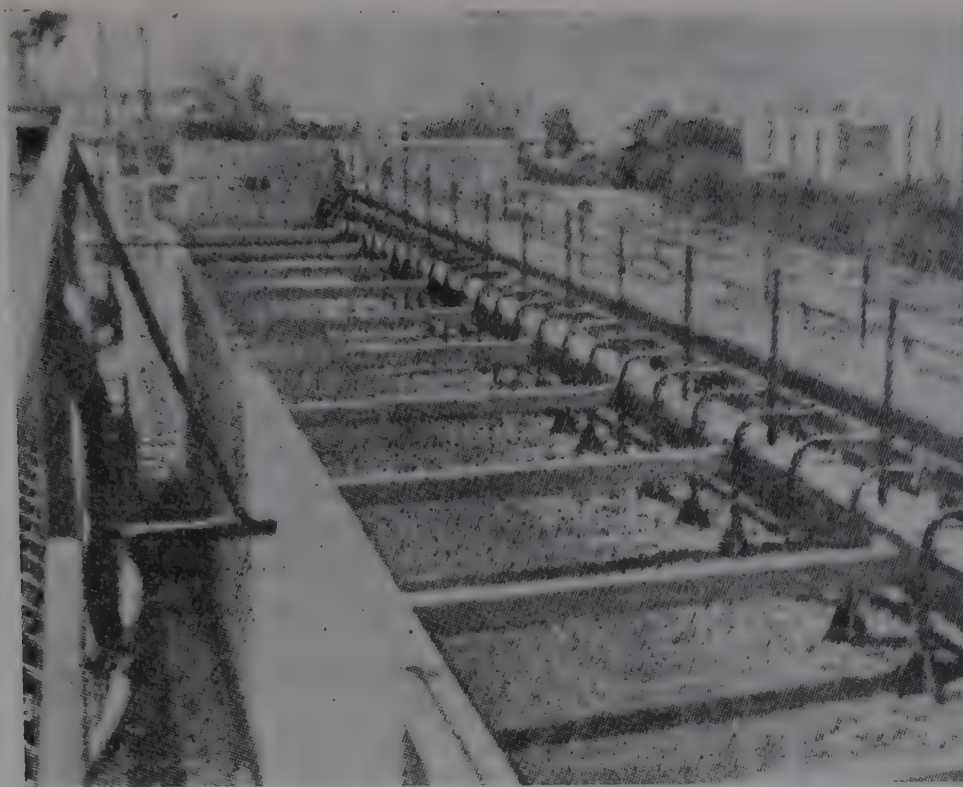


Fig. 1. Tertiary treatment plant for raw sewage.

RECYCLING OF WATER

By B. V. Bhoota

UP to a few years ago, we did not worry much about water since it was in plenty everywhere. This really induced misuse of water in every sense in that we used more quantities than we needed, and also we indiscriminately discharged industrial effluents which polluted these waters making them unfit for further use. The polluted water during its passage through rivers or large bodies of water has certain recuperating capacities, but this takes time which was available in the past. Due to the increasing need, however, especially arising from population explosion and also rapid industrialisation, never before has this topic of re-use of water been more relevant as it is today. We have to effect the recovery of polluted water by man-made devices based on scientific methods.

Tertiary treatment

In India, as elsewhere, we have treated with disrespect the sewages (human wastes) and effluents (industrial wastes) very indiscriminately. We have finally become aware of the need, on the one hand, of pollution control

and, on the other, of the need of optimum use of our water resources. The latter implies not only using the minimum or optimum quantity but also re-use as much as possible.

Waste-water treatment technology has advanced to the point of now being capable of yielding water suitable for industrial use. Several large-scale industries in foreign countries have now installed plants for treatment of domestic sewage and for producing the end-product which is acceptable for purposes such as cooling, processing, air-conditioning, etc.

Proposals for water reclamation and re-use were first made at least 25-30 years ago. During this period most of the attention has been directed to achieving higher efficiency in waste-water treatment so that the final effluent is as close to potable water as possible. Although the accomplishment of 100 per cent restoration is not yet possible for all parameters of quality, it must be admitted that technology is showing a distinctly hopeful sign of further improvement.

Public health engineers are aware of the working of some of the modern tertiary treatment plants producing

purified waste waters including the much publicised South Tahoe Water Reclamation Plant in the USA and the Windhoek Water Reclamation Plant in South Africa. Another frequently quoted example is of Bethlehem Steel at Sparrow Point, Maryland, USA, where the sewage from Baltimore City is purchased for reclamation and re-use. Starting with 25 million gallons per day (mgd) in 1942, the company had increased its demand to more than 125 mgd in 1966. Dow Chemicals Co is also using about 6 mgd of purified wastewater for its factory at Midland Michigan.

Dissolved solids

"Necessity is the mother of invention." Since water has become scarce in big cities like Bombay, raw sewage after tertiary treatment has been used for industrial purposes. This has been done at Chembur, a Bombay suburb, by Union Carbide for use in their plant and in many multi-storeyed buildings for air-conditioning. Similarly, certain types of industrial wastes could be re-used after removal of impurities; sometimes these impurities can even become sources of revenue.

Dr Bhoota is President of Dorr-Oliver (India) Ltd.

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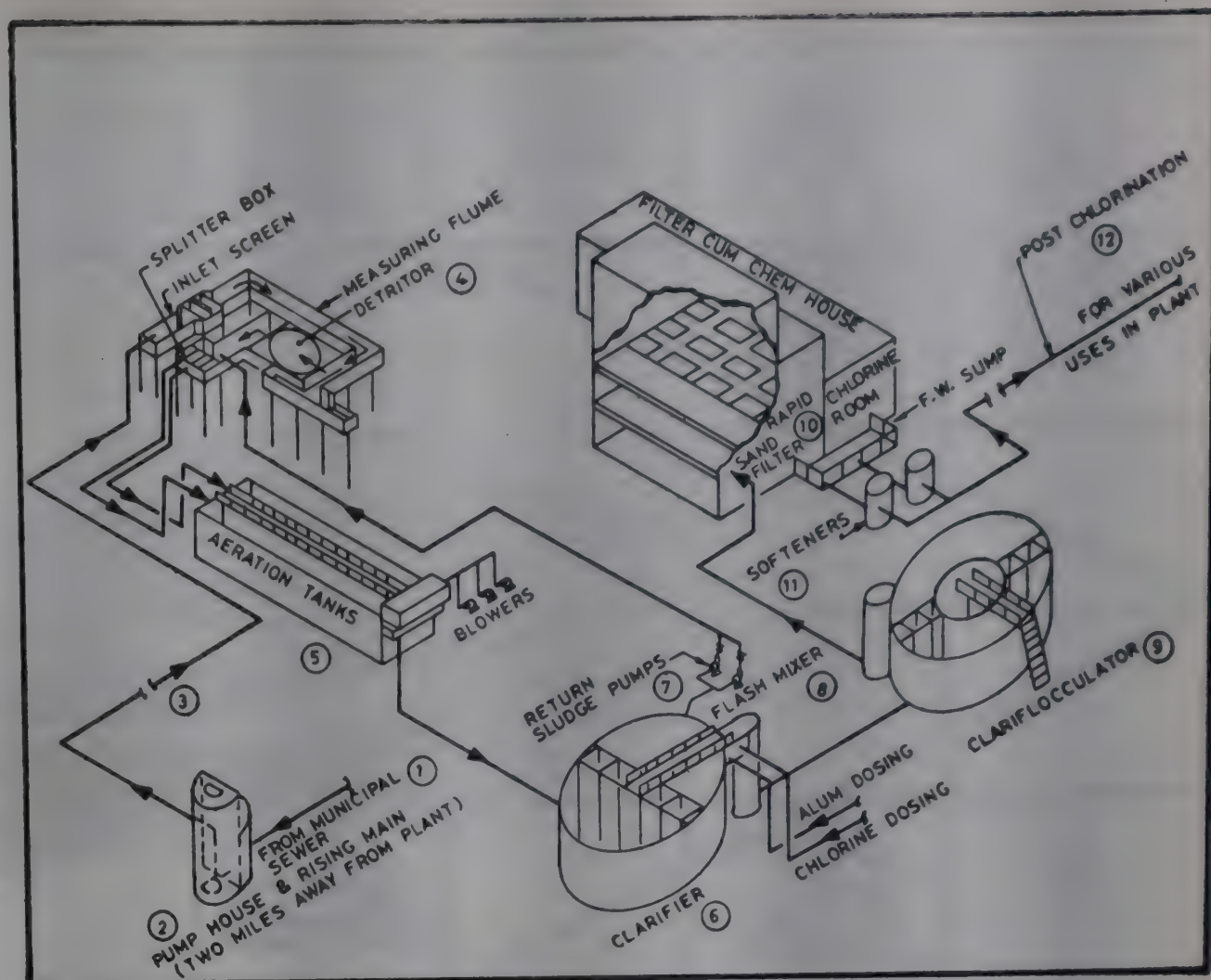
In considering the recycling of water, we can basically divide the waste waters into two parts:

Domestic sewage: This is the city sewage mixed up with the human excreta, and this domestic sewage should generally be kept free from industrial wastes. Depending upon the use of per capita water its strength varies, but it is the easiest waste to treat, especially if no industrial wastes are included, and considerable work has been done all over the world including India for treatment of such domestic sewage.

Re-use of domestic sewage is, thus, a very easy method since its characteristics are very well established and there is little variation from place to place. Well known and proven treatment processes are available. Treatment processes are not prohibitively expensive particularly where the need for industrial water is great and its cost is high.

It should be emphasised that besides the final effluent from raw sewage which can be used for industry certain by-products are available such as methane gas and organic humus-like sludge, the former for its heat value and the latter for its fertilising value. An additional benefit is that the pollution of the nearby rivers or waters is prevented.

Due to non-availability of water from the municipality, Union Carbide Co. Ltd, at their factory at Chembur, Bombay, went in for a modern tertiary treatment sewage plant for treating domestic sewage of 1 mgd (4.540 million litres per day (mld)). From the flowsheet of the plant it should be seen that besides the normal sewage treatment which generally forms part of complete treatment of sewage for discharge into nullahs or small rivers that is up to the final clarifier (Unit 6) the treatment has proceeded further in a clariflocculator, rapid sand filter, softener and then followed by post-chlorination. The latter steps are generally what are adopted in a modern water plant and thus the Union Carbide plant is a combination of a secondary sewage treatment plant plus a water plant. The price of treated and softened water is about 65 paise per 1,000 litres (1972) as compared to Rs 1.00 per 1,000 litres of municipal water. The effluent is softened because of process requirement and about 15 per cent of total water, which is used for boilers, is demineralised at an extra cost. The analysis of the raw and treated effluent (see Table 1) will indicate that there is little difference between the Bombay municipal water characteristics and reclaimed sewage, except



4.54 MLD TERTIARY TREATMENT PLANT AT UNION CARBIDE CO. LTD. CHEMBUR (BOMBAY)

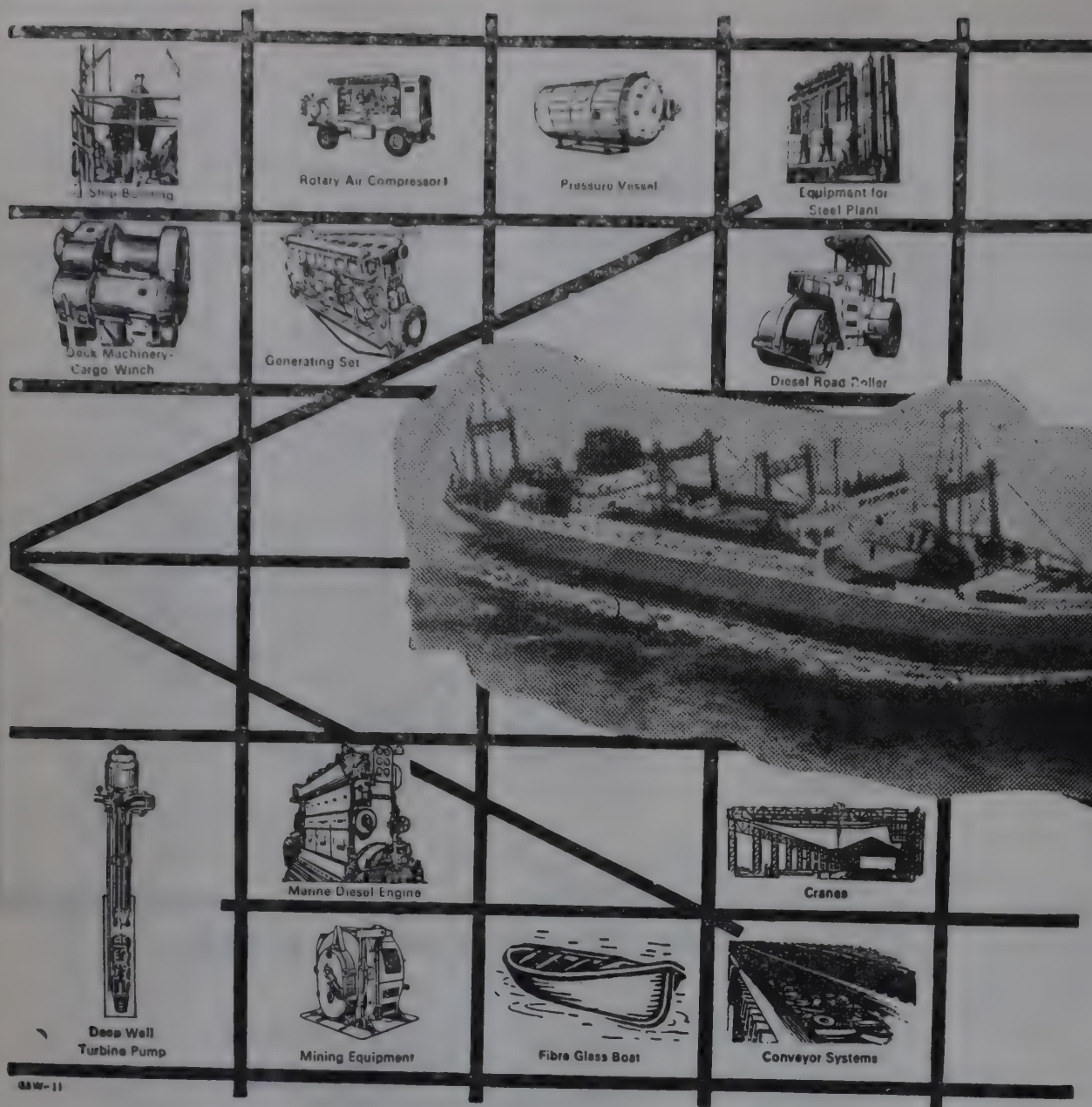
- (1) SOURCE OF SEWAGE, MUNICIPAL SEWER.
- (2) PUMP HOUSE.
- (3) RISING MAIN.
- (4) MEASURING FLUME AND DETRITOR.
- (5) AERATION TANK.
- (6) CLARIFIER.
- (7) RETURN SLUDGE PUMPS.
- (8) CHEMICAL DOSING EQUIPMENT FOR ADDITION OF ALUM AND PRE-CHLORINATION.
- (9) CLARIFLOCCULATOR.
- (10) RAPID SAND FILTERS WITH BACK-WASH EQUIPMENT.
- (11) SOFTENING.
- (12) POST-CHLORINATION.

that the dissolved solids are high. It should be emphasised that all sewage treatment processes aim at removal of organic matter, both dissolved and suspended, and inorganic only in the suspended form. The dissolved solids cannot be removed except by very costly methods and thus the re-use can only be done once or twice. If dissolved mineral salts are to be removed, softening is needed (for removal of hardness) and demineralisation for removal of inorganic dissolved salts. Cases are on record where in order to use the sewage effluents for domestic water supply or rather for charging the water aquifer the secondary sewage effluents have been injected into the ground for re-charging the water aquifer. Israel has done considerable work, and so have some of the dry areas of the USA such

as California and Arizona. It should be emphasised that to prevent build-up of dissolved salts beyond limit of potable water, only a part of the sewage can be recycled.

Investigations

Another example of re-use also in the city of Bombay is in the many multi-storeyed buildings such as Air-India, Mafatlal, State Bank, etc. In these multi-storeyed buildings, besides water requirement by the occupants, plenty of water is also required for central air-conditioning which was not made available by the Municipal Corporation. The treated effluent from domestic sewage is used for make-up of the cooling water required for air-conditioning such large multi-storeyed buildings, varying from 25,000 to 50,000 gallons per



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This, of course, is a specialised application, but the Union Carbide plant can be duplicated in many parts of the country, especially large cities where water is scarce.

Industrial effluents: Industrial effluents, unlike domestic sewage, are difficult to generalise. In spite of great advances made in the treatment and re-use of industrial effluents, it is not possible to deal with them in a simple worksheet like the one for domestic sewage for various reasons, such as:

1. There are almost as many types of effluents as there are industries.
2. Even in the same industry the quantity and quality may change depending upon the process used, also there could be wide variations in the quantity and quality from time to time.
3. For certain industrial waste waters, laboratory and even pilot plant investigations are necessary before a full-scale plant can be designed.
4. The cost of re-use varies from job to job, and it is difficult to generalise even on a limited basis. The question of re-use is really a question of economics in most cases.
5. In spite of the above uncertainties/disadvantages/limitations in the case of industrial effluents, it must be noted that technology—unit operatively and processwise—is so well advanced that an individual solution can easily be found—from the technology point of view—to treat any given individual effluent and render it fit for a given end use. *It is primarily a question of economics in most cases.*

Treatment of industrial effluents primarily calls for liquid-solid separation with or without chemical treatment, such as neutralisation, precipitation, oxidation and reduction. In some cases biological steps are also introduced for handling dissolved organic matters, and these steps also result in a further need of the same separation techniques. Liquid-solid separation and related other unit operations are, therefore, the key techniques. The greater the efficiency of these techniques, the better the poten-

tial for treatment and re-use of industrial effluents.

Industrial wastes may be broadly classified into four groups: (1) wastes from industries based on natural organic products; (2) wastes from organic chemical industry; (3) wastes containing inorganic pollutants; (4) wastes with radioactive substances.

Clarification

It can be generally stated that, except in very limited cases, re-use of water in industrial complexes is much more difficult and complex than that of domestic sewage. Generally, some treatment has to be adopted to reduce the pollution load to meet certain established standards which now the Central and "Prevention and Control of Water" Boards specify. Due to scarcity and high cost of water, however, re-use is being practised in various industries mostly in certain sections of the plant.

Modern technology has developed a wide variety of techniques for accomplishing liquid-solid separation. Among them are: screening, straining, sedimentation, scrubbing, filtration, centrifugation and ultrafiltration. Examples of some re-use are:

Steel mill: Every large steel mill in India practises conservation of water by re-use of certain effluents after clarification, cooling and sometimes chemical treatment. Briefly, the blast furnace flue dust water is re-used for washing down the flue dust again by counter-current method after treatment consisting of mostly clarification. The solid particles are removed and filtered and sent back to the sintering plants, and the liquid is being re-used. Thus, a very small make-up water is required in the system.

In the rolling mill section the scale pit overflow from the mill is re-used

back in the system after treatment consisting mostly of sedimentation. The effluent is used as cooling water or for washing down the scales again.

Pulp and paper mills: This industry is one of the largest consumers of water. The effluents of the pulp section are rather difficult to treat being highly organic and coloured. The treatment is only for reduction of the pollution load.

However, waste waters which mostly contain fibrous materials are easy to treat. These effluents are passed through Disc Savalls or DSM screens, followed by sedimentation at times. The recovered fibre is re-used (thus of profit to the industry) and the recovered water goes back again to the paper section for washing.

Textile mill: This is one of the largest water-consuming industries, most of the water being used for washing cloth at different stages of production. Generally, the re-use of water is practised from the waste waters of the kier sections, bleaching units, etc. It is estimated that around 20 to 25 per cent of the water needed in the textile mill can be re-used by proper recycling.

Thermal power stations: In thermal power stations using coal as fuel, the ash is removed using water as a transporting medium. Generally, the cooling tower blowdown is used for this purpose. At the disposal point, ash slurry is settled in open ponds, and the clarified water is pumped back into the system for re-use in transporting the ash. By this procedure the water is recycled, and the difficult problem of disposal of vast quantities of ash water is solved.

Oil refineries: The waste waters from certain sections having processes which contribute low impurity by way of oil and/or suspended matters are re-used after passing through oil sepa-

Table 1 : Quality of raw sewage, treated water and water from municipal main

	Raw sewage	Treated water softened and chlorinated	Water from municipal main
pH	7.15 — 7.65	7.1	7.8
Total hardness	120 — 162 mg/l	140 mg/l	39 mg/l
Alkalinity	125 — 200 "	135 "	40 "
Chlorides	96 — 130 "	60 "	18 "
Total dissolved solids	550 — 640 "	300 "	90 "
Suspended solids	70 — 100 "	Nil "	10 "
Turbidity	—	3 "	6 "
BOD at 20°C	220 — 250 "	1.0 "	1.2 "
COD	250 — 350 "	3.5 "	1.7 "

SOURCE: Union Carbide Co. Ltd., Chembur.

rators. Such water can be re-used for cooling towers, make-up water, etc. Such systems are being practised at Oil Refineries in Baroda and at Barauni.

Healthy environment

In conclusion, it is evident that a large number of effluents, domestic sewage and industrial waste waters can be re-used to a significant extent after suitable treatment. In many cases the

cost of treatment is modest compared to the overall benefits. It is becoming increasingly clear that re-use of effluents is an important step in the prevention of pollution, preservation of healthy environment and re-cycling of resources. There is need to place greater emphasis on these aspects in the early stages of industrial development since postponement or neglect will result in magnification of the adverse effects.

India, perhaps, is the only devel-

oping nation which has become aware of this need at a relatively early stage in its industrial development. As a result, India has taken several steps in the direction of pollution control which will eventually lead to a reduction of effluents to be discharged. Pollution control boards have been formed at Central and State level to implement pollution control measures. Industries and urban centres are being encouraged to treat and re-use their respective effluents.

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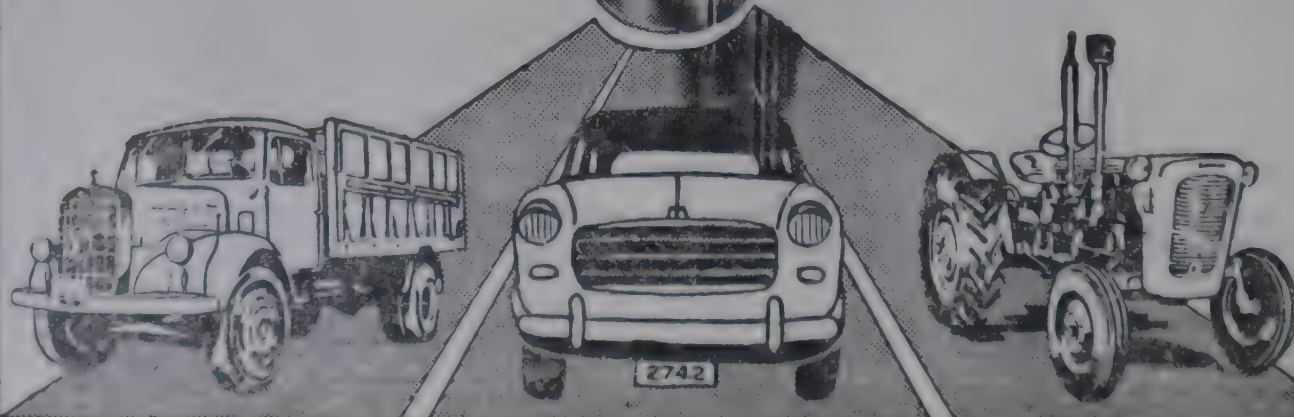


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How to tackle river-water controversies

By N. D. Gulhati

IN India we have had a long and varied experience in dealing with inter-State problems connected with the economic use of river waters. Most of our large rivers flow through two or more States of the Union; some of these rivers also flow from, or to, a neighbouring country. Changes in political boundaries, which have not been infrequent, also call for new agreements about use of river waters, or some change in agreements entered into earlier.

We have numerous agreements, both inter-State and international, in connection with many irrigation works in the territory of one party for the benefit of the other; agreements about works benefiting both parties; agreements about multi-purpose river developments in the interest of two or more parties. These agreements cover different modalities of organisation and financing, etc., and, of course, of execution and operation. How is it then that there has been a virtual suspension, for about a decade and more, of urgently required development on some of our major rivers because of inter-State disputes?

The simple answer to the above question is that, during the 1950s and 1960s, there came about gradually a discontinuity in the approach to the problem successfully adopted until then. Among other things, attempts were made to establish inter-State regimes for whole river systems on the basis of inadequate technical data and investigations; and senior engineers of State governments, who initially negotiated the solutions, were denied any such role. It would not serve much purpose to dwell on reasons for the departure from earlier practice; there are already indications of a reversion to the old well-tried path. What is important is to recapitulate the principal considerations relevant to a solution of controversies about the use of river waters and then to describe the methods and procedures which can be employed, successfully, for getting at solutions which would be lasting.

Law of the land

Under our Constitution, whereas the Central Government deals with all such matters relating to rivers as may concern any foreign country, each State has exclusive powers, within its territory, to make laws relating to, and to administer, the water resources of rivers, subject to such control by the Union on regulation and control of

inter-State rivers as may be determined by Parliament.

The use and development of the waters of an inter-State river by one State must not, however, adversely affect the exercise of similar rights by another State on the portion of the river in the territory of the latter. All States riparian to an inter-State river stand at an equal level or plane in respect of rights on the river; "each State has an interest which should be respected by the other." Parliament has accordingly made provision in the Inter-State Water Disputes Act 1956, for adjudication of disputes arising out of injury to such interests of one State by any action of another.

Parliament also passed an Act in 1956 to provide, for each inter-State river, institutional arrangements for the triple purpose of:

fostering regional co-operation among the basin States;

encouraging maximum economic benefits from our rivers; and

in the planning process, dealing with rivalries, or conflicts, about apportionment of these benefits and connected matters between concerned States.

It was only in 1963 that funds for setting up the arrangements, as described above, on some inter-State rivers were asked for and approved by Parliament. There was somehow a *volte-face* in policy soon thereafter, leading ultimately to the present unhappy situation.

Neither the Constitution nor any Act of Parliament has attempted to lay down a set of principles of general application to govern the relative rights of States in respect of the economic use of the waters of inter-State rivers; it is, in fact, not easy to do so. The British Government of India had held in 1935 that its decisions on inter-State rivers "are based upon administrative, and not legal, considerations... no decision can operate as a general precedent." Conditions vary widely from one region to another. 'Each river is a law unto itself' has almost become a cliché.

The non-existence of any specific law defining water rights of States, *inter se*, and of institutional arrangements to co-ordinate developments on inter-State rivers, as intended under the River Boards Act of 1956, would also seem to be reasons for the present impasse—the large number of current disputes, which have withheld much-needed development on several rivers, and have caused considerable loss to

Mr Gulhati, who took a prominent part in Indus Waters Treaty negotiations with Pakistan, is now a consultant on water resources development.

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nal economy—and for the strong
ons generated from time to time.

Sis of existing agreements

It is only on the Indus system of
s in the north-west that an effec-
international regime was estab-
d in 1960 by the Indus Waters
y between India and Pakistan;
ltaneously, an inter-State regime
een the States concerned within
a came into full effect on the Sutlej,
Beas and the Ravi, by virtue of
arlier accord reached in 1955.

On the Cauvery in the South, some
of inter-State regime had come into
g as early as 1892 when Mysore,
upper riparian State, had been obli-
d not to build any major irrigation
k on the river "without the
vious consent of the Madras Govern-
t," i.e., of the lower riparian State;
some of the smaller tributaries,
sore had freedom of action. Madras
s not to demand, however, all the
ural flow but only such as would
serve its prescriptive rights. This
to arbitration proceedings in
3-14; but the award of the Arbitrator
s suspended by the Secretary of
te at the request of Madras. Negotia-
ns were then undertaken in which
Consulting Engineer to the Gov-
ment of India assisted. An agree-
ment was reached in 1924 about which
ysore was never happy. With the
quality of status assured to all States
der the Constitution, Mysore (now
arnataka) claims that the 1892 Rules
d the 1924 'Agreement' have lapsed.

Agreements on all other river
systems relate primarily to specific pro-
cts. In connection with one of these,
e principle of equitable sharing of
waters was invoked as far back as 1867
y an engineer, the then Inspector
eneral of Irrigation in India. From an
amination of these agreements it
ppears that *the principle of equitable
portionment of benefits between basin
ates is generally upheld*. The quantum
f benefits which would represent an
equitable apportionment in any con-
rete case is not, however, easy to
etermine. Not only have the elements
onstituting equity been changing from
me to time but also the weightage to
e given to any one factor varies and
depends on the circumstances of each
ase. After a detailed study of the
problem, extending over about 12 years,
he International Law Association con-
cluded in 1966:

"What is a reasonable and equitable
share...is to be determined in the
light of all the relevant factors in
each particular case....

"The weight to be given to each
factor is to be determined by
its importance in comparison with
that of other relevant factors. In
determining what is a reasonable
and equitable share, all relevant
factors are to be considered together
and a conclusion reached on the
basis of the whole."

The decisions of the US Supreme
Court also firmly establish the princi-
ple of equitable apportionment. A re-
view of US case law also shows *Benefi-
cial use is the basis, the measure, and
the limit of the right to the use of water*.
Beneficial use is a matter of engineering
judgement; it varies with the stage of
development of the water resources
of the river and with the economic and
technological status of the basin States.

Safeguarding national interests

Whatever the solution of a river
water controversy may achieve for an
individual State, national interests de-
mand that this solution must also as-
sure to the country, as a whole, the
maximum benefits possible from the
river.

It would follow from the above that
if a storage reservoir is needed in one
State for the benefit, wholly or partly,
of another; or a storage dam in a down-
stream State would submerge some
territory in one or more upstream
States; or when the total benefits from
a co-operative undertaking on a river
would exceed those available from
independent developments within the
territories of each State, the States
concerned must co-operate and reach
agreement, on mutually acceptable
terms, or find alternative ways of
achieving equal benefits.

If the riparian States have been
unable, or are not likely, to use all
the waters available in a river system
and if, after due investigation, it is
found that there are, in fact, surplus
waters in the river system, surplus to
the requirements of the basin, then
national interests demand that these
surplus waters be taken to such deficit
regions in the country as are short of
water and can make economic use of
the available surplus.

There are several examples in India
of successful trans-basin diversions.
Similar trans-basin diversions provided
the final solution to the Indus waters
controversy between India and Pakis-
tan. Among other countries, the USSR
is presently engaged in working out
designs for the transfer of 32 million
acre-feet of water, annually, from its
north-flowing rivers to the basins of

rivers flowing into the Caspian Sea,
where this supply will meet local and
national needs.

More than ten years ago, the
Krishna-Godavari Commission had
found, after full discussion with all the
concerned States, that "much more than
10 million acre-feet of water would be
surplus to the requirements of projects
on the Godavari and can be diverted to
the Krishna basin." Investigations for
the diversion were recommended by the
Commission and approved by the Gov-
ernment of India. The Commission had
recommended: "Immediate steps be
taken to prepare an integrated plan
incorporating the power and irrigation
developments proposed by different
States in the lower Godavari area....
It should be possible on the basis of
the information contained in this re-
port, field reconnaissance and some pre-
liminary surveys to be carried out, to
prepare a preliminary project report in
about six months and establish the
feasibility, or otherwise, and scope of
the proposed diversions from the Goda-
vari to the Krishna." But no further
information on the subject is so far
available.

Whatever controversy may arise
between States about the use of river
waters must be settled quickly in the
interest of economic development, as
also in the interest of national integra-
tion.

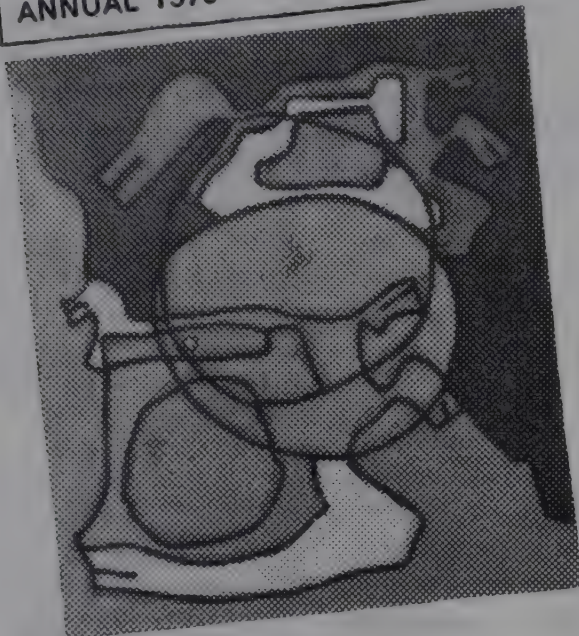
Controversies with regard to indivi-
dual works present small difficulties
when compared to those relating to ap-
portionment of the waters of an entire
river system. For the latter, large
volumes of technical data, their analyses
and engineering investigations, in fact,
alternative master plans (in outline)
must be prepared and examined before
an optimum solution can be found which
would satisfy the reasonable aspira-
tions of all the States concerned and
also be in the national interest.

Essentials of a lasting solution

Whenever the solution of an inter-
State controversy on use of river waters
cannot be found without establishing
an inter-State regime on the river,
which means the final apportionment of
all its waters between the concerned
States, to the extent possible, *the solu-
tion should afford to each State the
greatest possible freedom of action in
the construction, operation and manage-
ment of its projects*, subject only to the
requirements of co-ordination between
related activities of other basin States;
which requirements must be specified
in full in an agreement. This feature

THE ECONOMIC TIMES ANNUAL-1975

THE ECONOMIC TIMES
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Problems of Industrialisation

The Economic Times Annual is devoted this year to a searching discussion of some of the problems of industrialisation. Studies are devoted to a critical assessment of industrial policy, licensing problems, structure of Indian industry and the operations of multinationals.

Experts examine the relevance of the concept of monopolies in a poor country and problems of production and consumption planning.

An entire section is devoted to an empirical evaluation of the changing structure of Indian industry, the corporate sector, the problem of financial management, the energy crisis and the public sector.

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TIMES ART

against all interference by states in the supplies allotted to it, reduces the chances of new frictions and tensions and contributes to improved relations between States and national integration. It is this feature of the Indus Waters Treaty, which has enabled it to survive the otherwise strained relations between India and Pakistan, even open hostility. This feature is also a strong point in the recent agreement between Maharashtra and Andhra Pradesh on the Godavari.

Water being dynamic by nature, anything associated with it is liable to change with time, or need some modification. Similarly, economic factors and requirements of the river community—elements commonly used in apportioning equitable apportionment—change from time to time. For various and other reasons, the solution must provide for a permanent inter-State body—a commission, or a board—to establish co-ordination in the operation of all projects on the river system and to foster, between the parties, a co-operative approach to all problems of the river that may arise in future.

As an example, the River Murray Commission was set up in Australia under the River Murray Agreement of 1933, which reconciled the divergent interests of New South Wales, Victoria, South Australia, and found a sound basis for harnessing Australia's greatest river in the service of the Nation. This Commission comprises representatives from the Federal Government and the three States. It was through this Commission that until 1961, the agreement remained "has subsequently been amended in 1923, 1934, 1948, 1954 and 1958" to provide for variations in the works to be constructed... and in allocation of water between three States in times of restriction.

"The agreement provides that on matters of importance the decision must be unanimous by all the members of the Commission. In the absence of agreement the Chief Justice of Tasmania (an island State) may nominate an arbitrator. In its 46 years of existence, however, the Commission has no time failed to reach agreement."

The U. S. -Canada Boundary Waters Treaty of 1909 created a permanent International Joint Commission of the United States and Canada, composed of three commissioners of each country. This Commission "shall have jurisdiction over and shall pass upon all cases

involving the use or obstruction or diversion of the waters" defined in the Treaty and deal with such other problems as may be referred to it by the two Governments.

The Indus Waters Treaty provides for a permanent Indus Commission comprising one Commissioner each from India and Pakistan. Its functions are defined in the Treaty.

There are several such inter-State bodies for specific rivers in the United States. The Krishna-Godavari Commission recommended in 1962: "The Commission recommends that an inter-State body, a River Board or by whatever name called, should be established without any delay, for bringing about a co-operative approach and establishing the necessary co-ordination in the planning and operation of various developments in the two river basins. The integrated operation of all projects, which is indispensable, would not be possible without such a co-ordinating body."

Judicial decisions

Inter-State rivalries or conflicts about use of river waters "constitute a classical example of disputes which cannot be satisfactorily solved by judicial decision." In a recent review of "Indus Waters Treaty", Prof. C. B. Bourne of the Faculty of law, University of British Columbia, writes in Canadian Yearbook of International Law, Vol. XII, "... the law even when rightly understood, can take one only part of the way towards a solution of a problem of equitable utilisation: this solution depends in the last analysis upon functional considerations..."

In the United States which, like India, is a federation of States and has many inter-State rivers, the Supreme court exercises jurisdiction over inter-State river water disputes, but "... in no case has the court laid down a specific formula for the apportionment of the water of an inter-State river... The court has quite consciously left the details of the necessary regulation to the disputing States as this involves an executive and legislative rather than a judicial function, and has restricted itself to stating whether present injuries or injuries to be expected in the future... were sufficiently established."

The details of regulation, etc and, in most cases, the apportionment of waters is obtained through compacts negotiated between the concerned States. These compacts generally make

provision for a joint permanent commission or agency.

The U. S. Supreme Court has stated: "... these controversies between states over the waters of interstate streams... present complicated and delicate questions, and, due to the possibility of future change of conditions, necessitate expert administration rather than judicial imposition of a hard and fast rule. Such controversies may appropriately be composed by negotiation and agreement..."

A joint committee of British Parliament stated in 1935: "... the experience of most countries has shown that rules of law based upon the analogy of private proprietary interests in water do not afford a satisfactory basis for settling disputes between Provinces or States where the interests of the public at large in the proper use of water supplies are involved..."

With all due respect to the high judicial acumen of an Arbitral Tribunal, judges cannot be expected to plan the economic use of river waters. The procedures adopted in any arbitral proceedings are bound to create bitterness among the parties which make subsequent implementation almost impossible. A judicial decision, or the award of a tribunal is hardly likely to satisfy all parties, it may not satisfy any one. It may stand in the way of maximising developments from a river, if for no other reason, by freezing a situation otherwise capable of being improved upon by further study or by development of engineering technique. On matters closely related to the permanent well-being of large sections of the population, it is extremely difficult to control emotions and passions that may be generated and one cannot hold, with confidence, that the award of the Tribunal, the limitations imposed, would be faithfully administered by the concerned State or States on which rest the ultimate responsibility and the authority to control the waters.

In 1951, when Eugene R. Black, President of the World Bank, proposed that "the problem of development and use of the Indus basin water resources should be solved on a functional and

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a political plane...", Prime Minister Jawaharlal Nehru replied that this was "to a large extent, in line with what we have ourselves suggested in the past." He readily agreed, therefore, that it was "an engineering matter and could be dealt with as such."

The engineering solution which ultimately led to the Treaty and under which India got 12 million acre-feet of water previously in use in Pakistan could hardly be expected from any judicial tribunal.

In the inter-State agreements negotiated bilaterally in India, there are numerous instances of accommodation shown by one State for the benefit of the other.

Negotiated settlement

It would be obvious from the above that, no matter how one views the problem, a negotiated settlement provides the best possible solution for conflicting claims of two or more States on the waters of an inter-State river, or about other matters connected with the use of these waters. In the ultimate analysis, in such conflicts, equity also lies in what the parties agree upon as equitable.

Having been voluntarily agreed to, a negotiated agreement leaves no bitterness behind. It carries with it the best prospects of being implemented faithfully; this aspect may, in some cases and in course of time, become even more important than the initial resolution of the controversy. Accordingly, all the time, energy and thought that may have to be spent to secure a mutually acceptable agreement is worthwhile.

Modus operandi

The best way to get an agreement, as described above, is that initial negotiations should be held between technically qualified representatives of the parties concerned and that their recommendations, even if not unanimous, should be considered at the political level. L. R. East, Vice-President, International Commission on Irrigation and Drainage, and a Commissioner of the River Murray Commission in Australia,

stated in 1961 in the course of an article in ICID Bulletin:

"Negotiations within the Commission have been greatly facilitated by the fact that the Commissioners are by profession engineers and have adopted a realistic approach. . . . Having personal knowledge of all the technical factors involved, they were not handicapped by dependence on their understanding of 'briefing' prior to commencement of negotiations.

"The essentially defensive approach which is fairly prevalent in compact negotiations and administration seems to break down fairly rapidly when the negotiators are engineers who are (free to be) influenced more by factual data than by partisan politics", or parochial interests.

The general approach to the problem must be functional; political and other matters between the contending parties must not be allowed to interfere with the settlement of the water controversy. The hydrologic unity of a river basin must be recognised. For controversies relating to isolated works, a detailed examination must be made of the availability of waters required for the project, or projects, after allowing for all existing and future uses, upstream; and of the hydrological consequences of the operation of the project, or projects, on existing or future works, downstream on the river.

When the solution of a controversy involves the apportionment of all the waters of a river system, to the extent possible, *surface waters and groundwater must be considered together*. In this connection it is necessary to note the following conclusion reached during technical discussions at the Ninth Congress on Irrigation and Drainage in Moscow in August last: "The discussions have shown that in the majority of countries only a small proportion of the known and available groundwater reserves have so far been exploited. . . . It is clear that the planning of conjunctive use of surface water and groundwater for irrigation must be based on sound hydro-geological forecasts as well

as feasibility studies which must take into account not only capital investment and operational costs, but also optimum results from the use of water and land and human resources."

To assure optimum development to accommodate all existing and proposed schemes, and to guard against potential conflicts, a master plan (outline), or alternative master plans must be prepared (with active co-operation of the parties) as a preliminary to the search for a solution.

In preparing master plans, referred to above, the climatic variations and the soils in different parts of the basin must be considered together with available water resources (river flow and groundwater) in each part. The benefits to be derived may not, however, be confined necessarily to the basin.

Right from the beginning of the negotiations at the technical level, or at any time later, as and when found necessary, help may be sought from a mediator, or mediators, *acceptable to the parties*. Recognising the complexities inherent in river water controversies, "the cardinal fact that each river basin is an entity, and that irrigation planning must take cognisance of this fact and must therefore be related to the physical, meteorological and socio-economic features of the basin as a whole," the Irrigation Commission 1972 recommended that "the Union Government should play a beneficent role in settling intractable inter-State water disputes on lines similar to those adopted by the World Bank in the Indus Waters Dispute."

In making the above recommendation, the Commission refers, presumably both to the mediatory efforts of the World Bank (patient, continuing efforts extending over nine years by a special group of 6-12 persons) and the large financial assistance the Bank secured for the construction of works in Pakistan (both for replacement of supplies to be used by India and for development in Pakistan). The Central Government, it has to be noted, does not presently employ any such special group for mediatory work.

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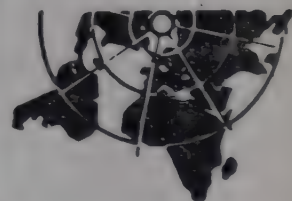
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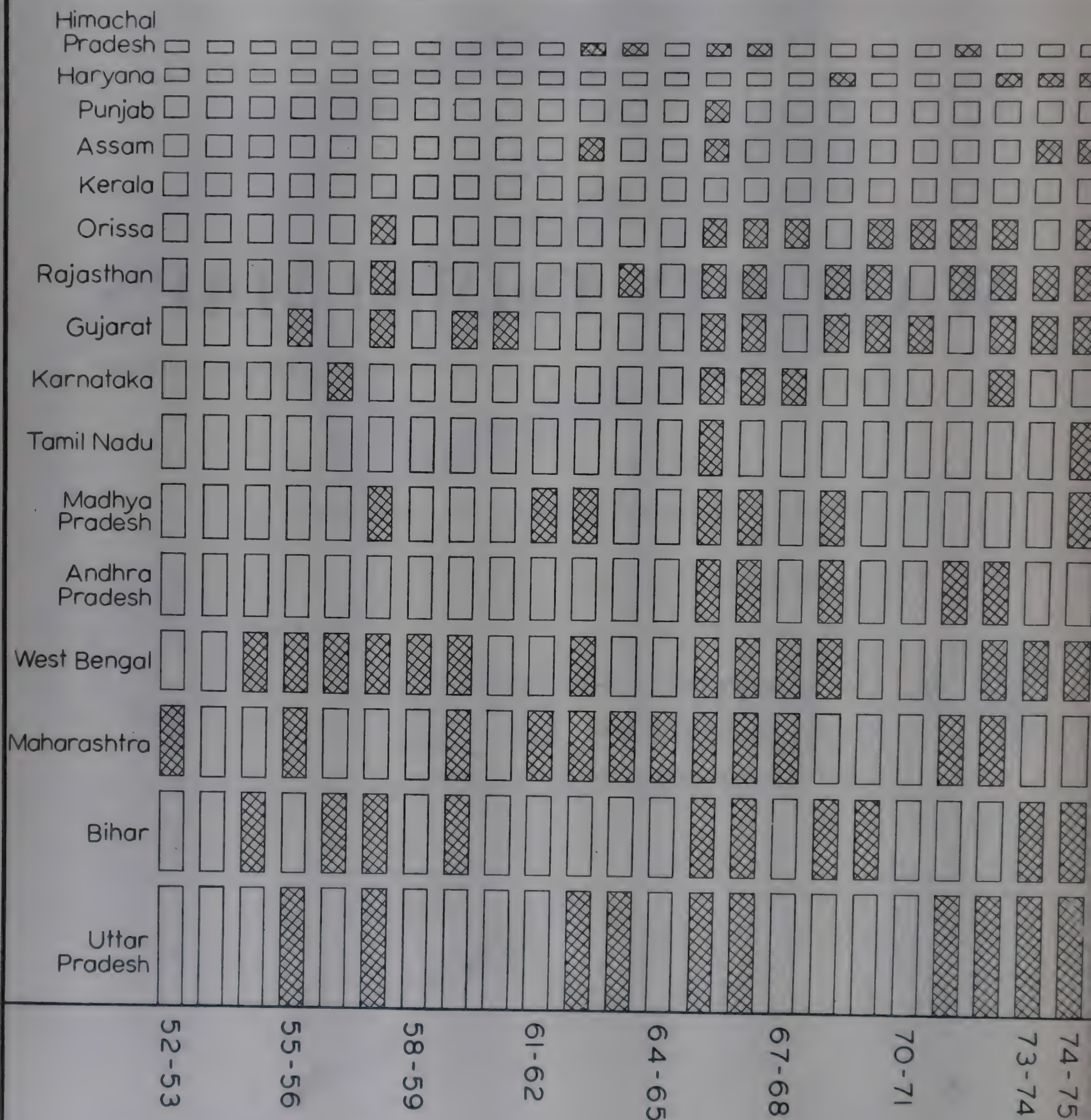
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WATER IN INDIA: MAPS

By COMMERCE RESEARCH BUREAU

Setbacks in agricultural production due to droughts and floods	172
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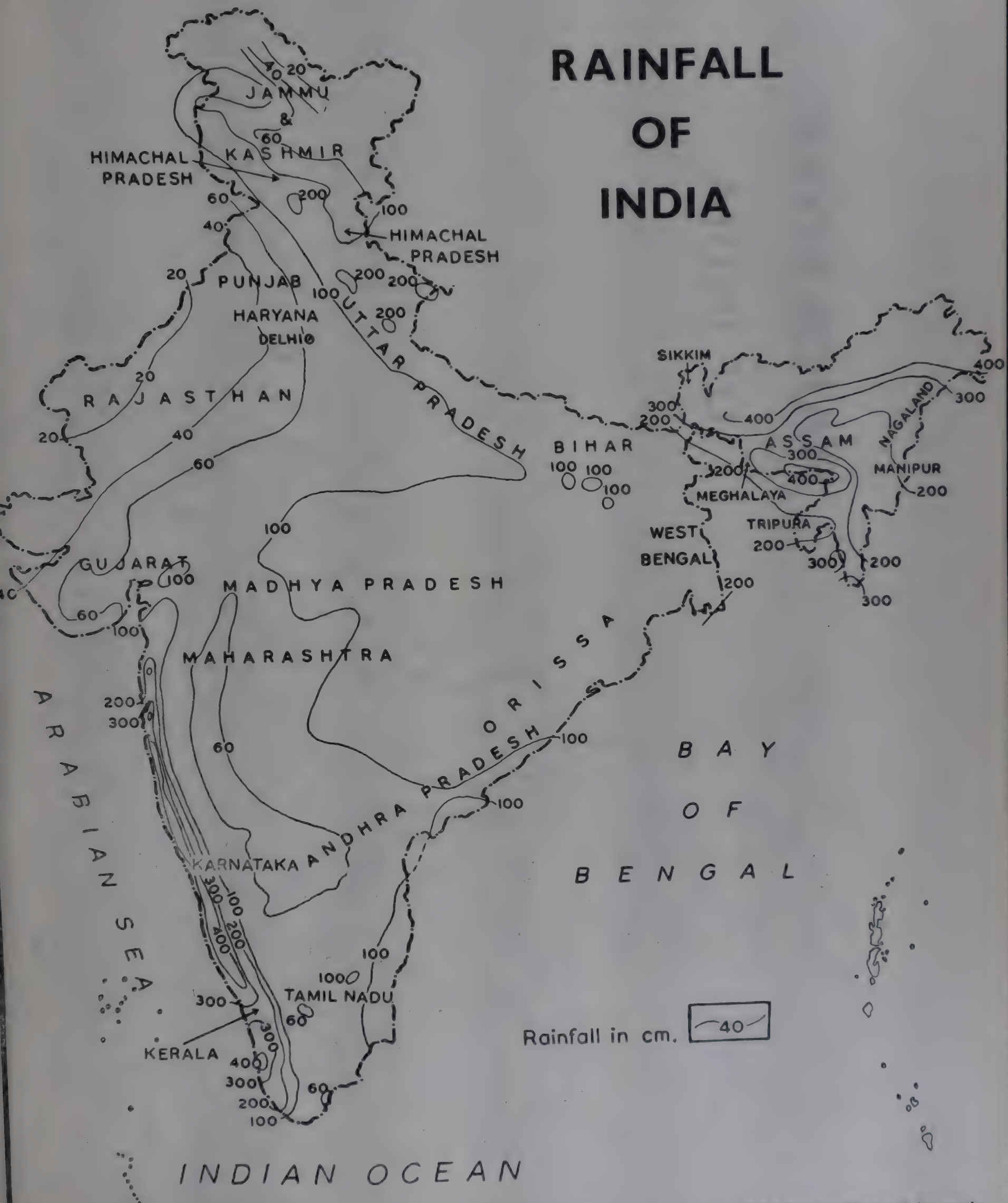
SETBACKS IN AGRICULTURAL PRODUCTION DUE TO DROUGHTS AND FLOODS



Notes : 1 Shaded rectangle indicates a drop in agricultural output either due to drought or flood by 5% or more in that particular year compared to the previous peak in production.

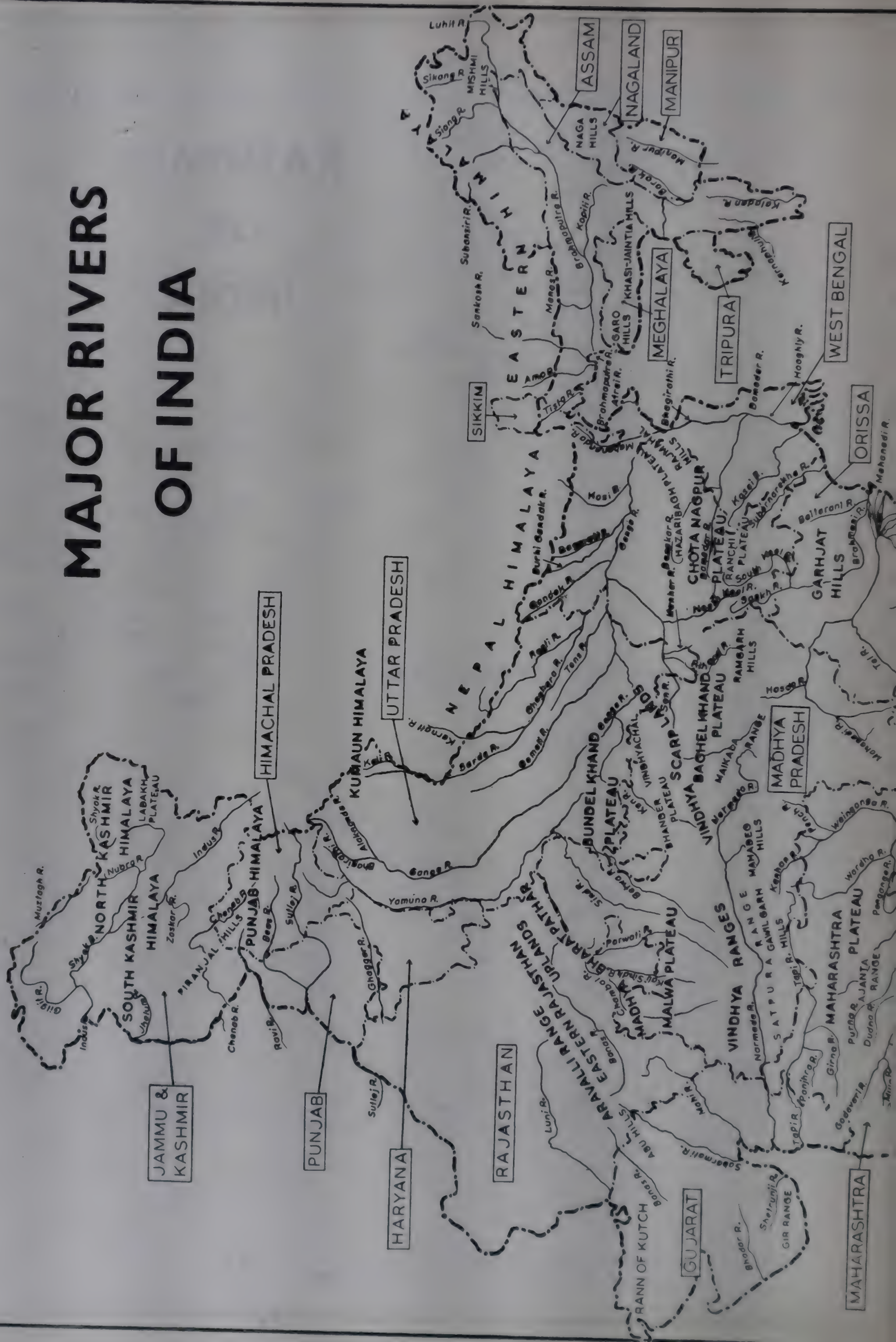
2 The vertical height of each rectangle is proportionate to the population of the state.

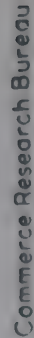
RAINFALL OF INDIA



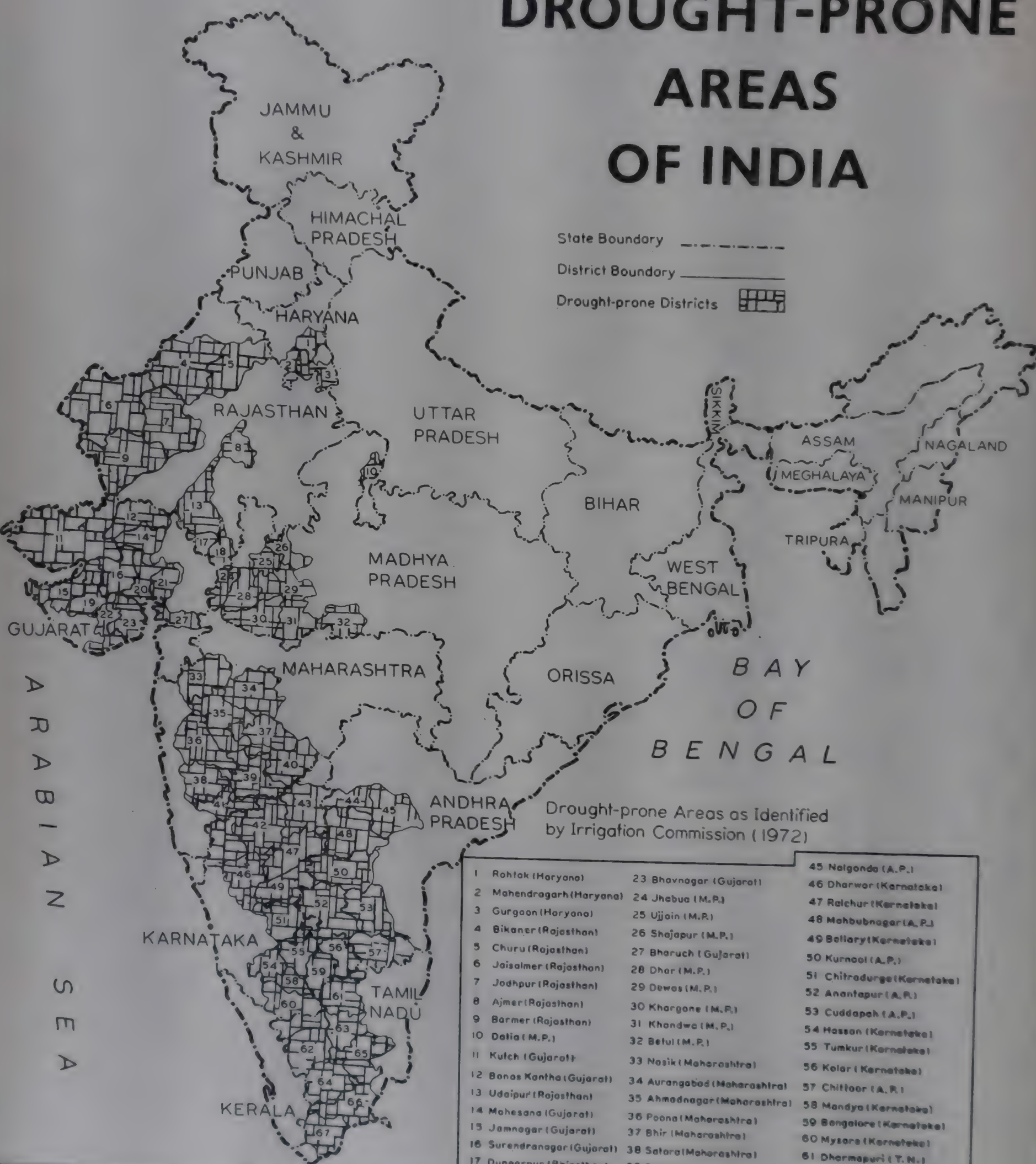
NOTE: Illustration not to scale

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DROUGHT-PRONE AREAS OF INDIA



Drought-prone Areas as Identified
by Irrigation Commission (1972)

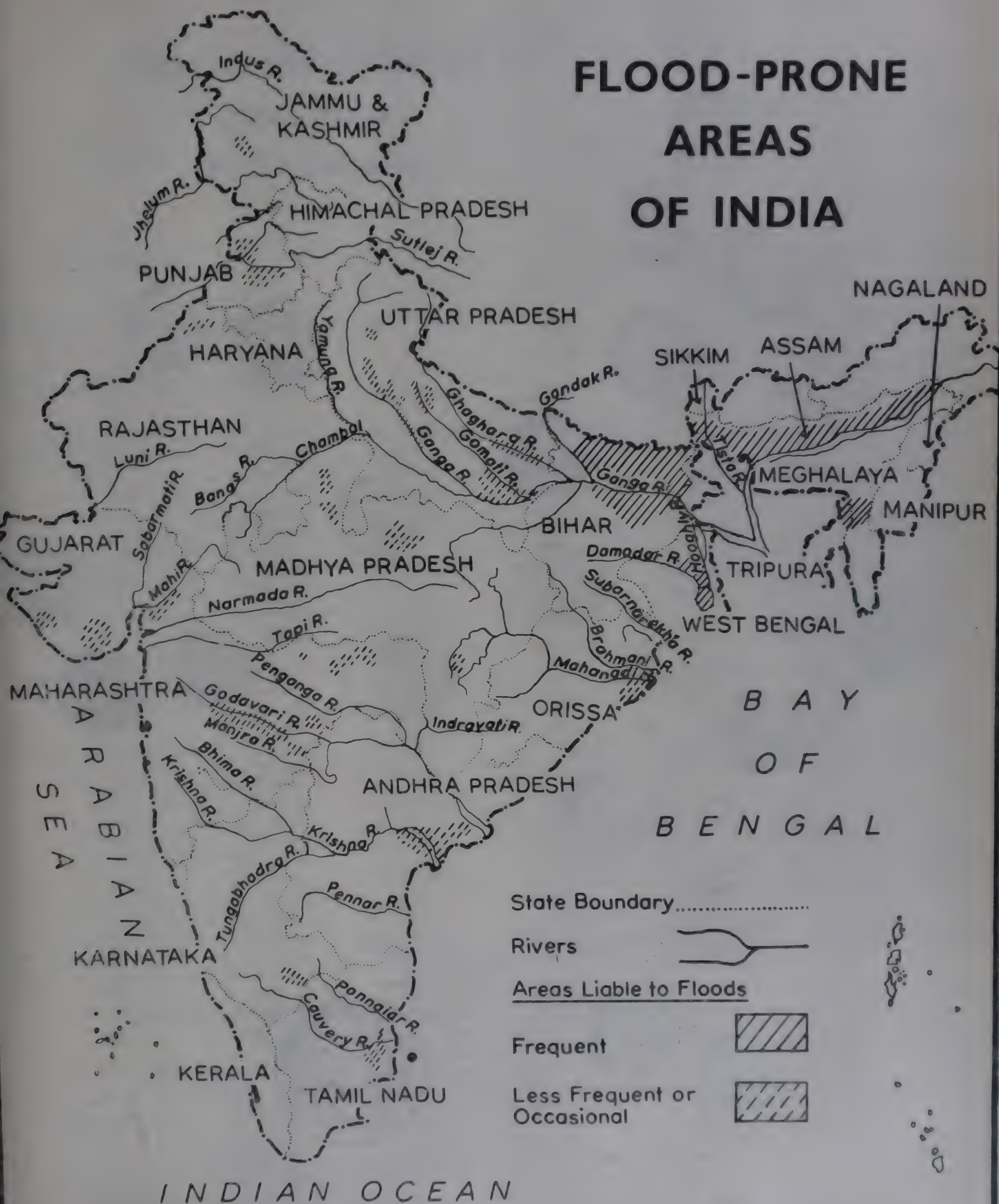
- | | | |
|----------------------------|-----------------------------|----------------------------|
| 1 Rohtak (Haryana) | 23 Bhavnagar (Gujarat) | 45 Nalgonda (A.P.) |
| 2 Mahendragarh (Haryana) | 24 Jhabua (M.P.) | 46 Dharwar (Karnataka) |
| 3 Gurgaon (Haryana) | 25 Ujjain (M.P.) | 47 Raichur (Karnataka) |
| 4 Bikaner (Rajasthan) | 26 Shajapur (M.P.) | 48 Mahbubnagar (A.P.) |
| 5 Churu (Rajasthan) | 27 Bharuch (Gujarat) | 49 Bellary (Karnataka) |
| 6 Jaisalmer (Rajasthan) | 28 Dhar (M.P.) | 50 Kurnool (A.P.) |
| 7 Jodhpur (Rajasthan) | 29 Dewas (M.P.) | 51 Chitradurga (Karnataka) |
| 8 Ajmer (Rajasthan) | 30 Khargone (M.P.) | 52 Anantapur (A.P.) |
| 9 Barmer (Rajasthan) | 31 Khandwa (M.P.) | 53 Cuddapah (A.P.) |
| 10 Dalia (M.P.) | 32 Betul (M.P.) | 54 Hassan (Karnataka) |
| 11 Kutch (Gujarat) | 33 Nasik (Maharashtra) | 55 Tumkur (Karnataka) |
| 12 Banaskantha (Gujarat) | 34 Aurangabad (Maharashtra) | 56 Kolar (Karnataka) |
| 13 Udaipur (Rajasthan) | 35 Ahmednagar (Maharashtra) | 57 Chitloor (A.P.) |
| 14 Mahesana (Gujarat) | 36 Poona (Maharashtra) | 58 Mandya (Karnataka) |
| 15 Jamnagar (Gujarat) | 37 Bhir (Maharashtra) | 59 Bangalore (Karnataka) |
| 16 Surendranagar (Gujarat) | 38 Satara (Maharashtra) | 60 Mysore (Karnataka) |
| 17 Durgapur (Rajasthan) | 39 Solapur (Maharashtra) | 61 Dharmapuri (T.N.) |
| 18 Banswara (Rajasthan) | 40 Osmanabad (Maharashtra) | 62 Coimbatore (T.N.) |
| 19 Rajkot (Gujarat) | 41 Songli (Maharashtra) | 63 Salem (T.N.) |
| 20 Ahmedabad (Gujarat) | 42 Bijapur (Karnataka) | 64 Madurai (T.N.) |
| 21 Kheda (Gujarat) | 43 Gulbarga (Karnataka) | 65 Tiruchirappalli (T.N.) |
| 22 Amreli (Gujarat) | 44 Hyderabad (A.P.) | 66 Ramnathapuram (T.N.) |
| | | 67 Tirunelveli (T.N.) |

NOTES: 1. Not necessarily, all the districts are wholly drought-prone.
Names of drought-prone talukas are given under the respective State write-ups.

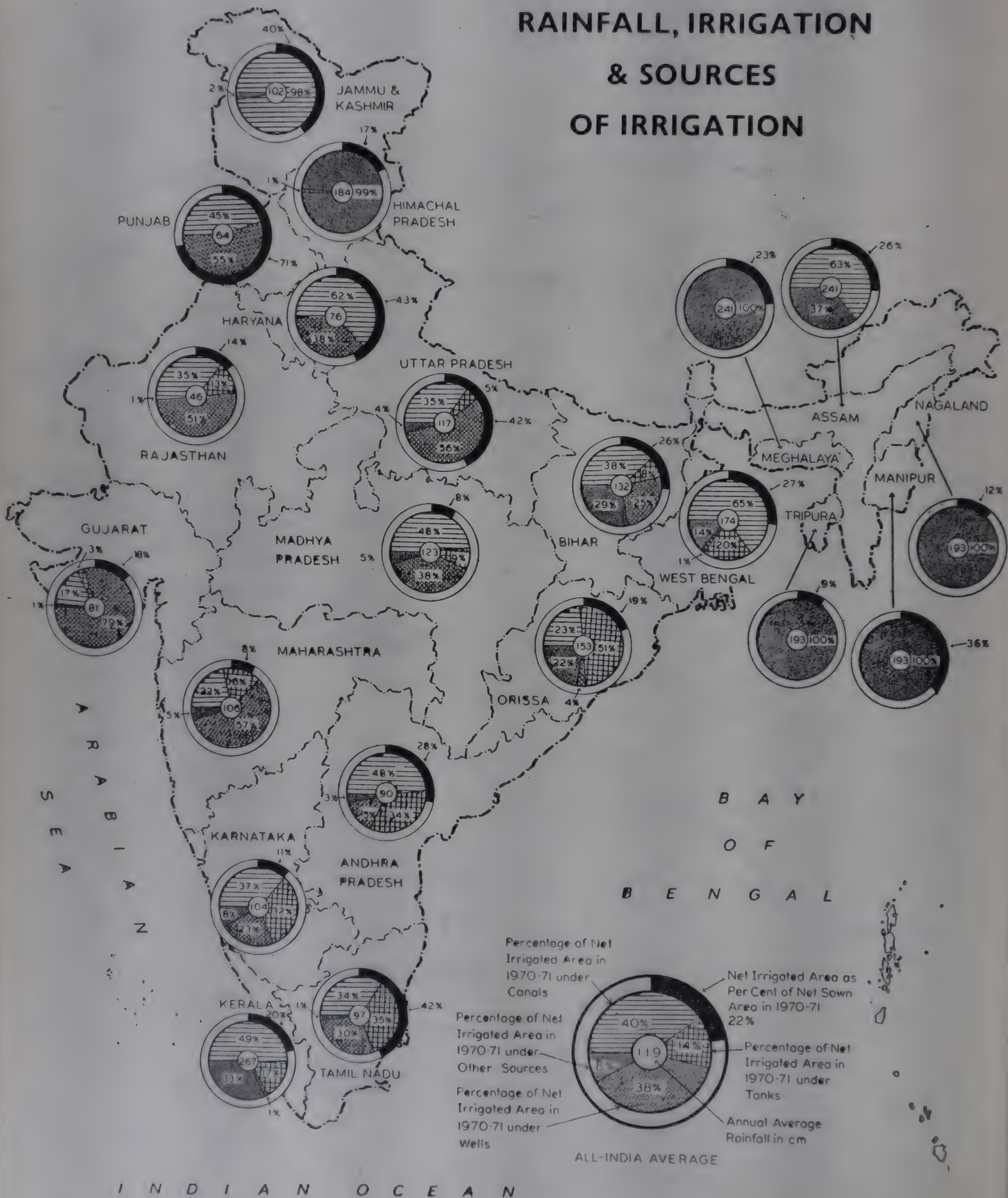
2. Illustration not to scale.

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FLOOD-PRONE AREAS OF INDIA



RAINFALL, IRRIGATION & SOURCES OF IRRIGATION



STATE REVIEWS

By COMMERCE RESEARCH BUREAU

ANDHRA PRADESH

Over one-third area drought-prone

EXCEPT for the most irrigated rich deltaic tract on the east which covers one-third of its total area, Andhra Pradesh, by and large, has less fertile soils and inadequate and unassured water resources. But it has a 1,000-km coastline, the second longest next only to that of Gujarat.

Rainfall: On an average, the State receives an annual rainfall of 90 cm (35 inches), which is unevenly distributed both in time and space (Table 1). While most of the rainfall in the State is received from July to September from the south-west monsoon, the southern coastal districts of Nellore, Prakasam and Chittoor and a few other parts receive rain from the north-east monsoon also during November-December. The south-western districts of Rayalaseema which lie in the rain-shadow of the Sahyadri (Western Ghats) receive scanty annual rainfall of about 50 cm to 60 cm (20 to 24 inches).

But as one goes northward the precipitation is higher and higher. In the north-eastern districts the average rainfall is about 100 cm (39 inches). Thus, the rainfall varies from 50 cm (20

inches) in Anantapur district to 100 cm (39 inches) in Srikakulam district. But, in no part anywhere in the State, is the rainfall heavy. About two-thirds of the net sown area falls under the medium rainfall region (75 cm to 115 cm or 30 to 45 inches), while one-third under the low rainfall region (below 75 cm or 30 inches).

Drought-prone areas: According to the estimates made by the Union Ministry of Food and Agriculture as

scanty rainfall. All the talukas in the districts of Anantapur, Kurnool and Nalgonda are drought-prone and the centrally sponsored drought-prone area development programme with the World Bank assistance is being implemented in Anantapur district.

Rivers: The Godavari, the longest and broadest river of south India, and the Krishna form the most important river systems of the State. Besides there are 38 medium and minor river basins. Important among them are the Gundlakamma, the Muneru, the Nagavali, the Penner, the Tungabhadra and the Vamsadhara. All the rivers are rain-fed and their waters shrink considerably during summer. But they together, according to the Irrigation Commission (1972), contribute about 1,85,052 m.cu.m. of water amounting to about

Table 2 : Districts and talukas identified as drought-affected

District		Taluka
1. Anantapur	..	Anantapur, Dharmavaram, Gooty, Hindupur, Kadiri, Kalyandrug, Madakasira, Penukonda, Rayadurg, Tadpatri, Uravakonda
2. Chittoor	..	Chandragiri, Chittoor, Kuppam, Madanapalle, Palmaner, Punganur, Vayalpad
3. Cuddapah	..	Badvel, Cuddapah, Jammalamadugu, Kamalapuram, Proddatur, Pulivendla, Rajampet, Rayachoti
4. Hyderabad	..	Chevella, Hyderabad (East), Hyderabad (West), Ibrahimpatnam
5. Kurnool	..	Adoni, Allagadda, Alur, Atmakur, Banganapalle, Dhone, Giddalur, Koilkuntla, Kurnool, Markapur, Nandikotkur, Nandyal, Pattikonda
6. Mahabubnagar	..	Achampet, Alampur, Atmakur, Gadwal, Kalvakurthi, Kollapur, Makthal, Nagarkurnool, Shadnagar, Wanaparthy
7. Nalgonda	..	Bhongir, Devarakonda, Huzurnagar, Miryalguda, Nalgonda, Ramannapet, Suryapet

SOURCE : Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972 Vol. I, Appendix 8.1, pp. 420-424.

Table 1 : Seasonal distribution of rainfall (Cm)

Period	Coastal Andhra	Telangana	Rayalaseema
July to September ..	57	75	37
October to December ..	33	8	21
January to May ..	10	8	10
Total ..	100	91	68

SOURCE : "Development of Water Resources in Andhra Pradesh," appeared in Souvenir of U. N. Seminar on Water Resources Administration, Central Water and Power Commission, New Delhi, January 1973.

mentioned in Fourth Five-Year Plan, Andhra Pradesh A Draft Outline, about three-fifths of the area affected by scarcity conditions in the southern region is concentrated in Andhra Pradesh alone. The Irrigation Commission (1972) has identified 60 talukas in seven districts as susceptible to droughts (Table 2). These areas account for 37 per cent of the State's total area and one-fourth of its population. The Rayalaseema region forms the core of the chronic famine area of the State on account of rocky and unyielding soil and

11 per cent of the total flow in all the Indian rivers, excluding the Brahmaputra. Out of this, while 61,674 m.cu.m. is being utilised by the upper riparian States, 32,083 m.cu.m. is the present utilisation of Andhra Pradesh. Thus, half of the water still remains unutilised.

The State's dispute with the neighbouring States on the sharing of waters of the Godavari has been pending before the tribunal since 1969. However, on December 19, in a meeting presided over by the Union Minister for Agri-

RIVER SYSTEM OF ANDHRA PRADESH



ulture and Irrigation, Mr Jagjivan Ram, the Chief Ministers of the States involved in the dispute reached an agreement through mutual talks relating to the sharing of as much as 2,300 TMC ft (thousand million cubic feet) of waters out of a total of 3,000 TMC ft in the Godavari basin. Mr Jagjivan Ram explained that the remaining amount of available water poses no dispute at the moment because, for another 15 years or so, no new project is being envisaged by any of the States concerned. The agreement will be now filed before the Tribunal and the Chief Ministers desire that the projects and programmes on which the accord has been reached need not be discussed.

Following are the highlights of the projects agreed to by Andhra Pradesh and Maharashtra (reported in *The Times of India*, December 20, 1975):

I. Maharashtra can use all waters up to the Paithan dam site on the Godavari and up to the Siddheswar dam site on the Purna.

II. (i) From the waters in the area of the Godavari basin below the Paithan dam site on the Godavari and below the Siddheswar dam site on the Purna and below the Nizamsagar dam site on the Manjra and up to the Pochampad dam site on the Godavari, Maharashtra can utilise waters not exceeding 60 TMC ft for new projects, including any additional use over and above the present sanctioned or cleared utilisation as the case may be.

II. (ii) Andhra Pradesh can go ahead with the building of its Pochampad project with an FRL of 1,091 and MWL of 1,093 and is free to utilise all the balance waters up to the Pochampad dam site in any manner it chooses for its beneficial use.

Maharashtra will take necessary action to acquire any land or structures that may be submerged under the Pochampad project and Andhra Pradesh agrees to bear the cost of acquisition, the cost of rehabilitation of the displaced families and the cost of construction of some bridges and roads that may become necessary. Maharashtra also agrees to the submersion of the river and stream beds.

III. (i) In the Manjra sub-basin above the Nizamsagar dam site, Maharashtra can utilise waters not exceeding 22 TMC ft for new projects, including any additional use over and above the present sanctioned or cleared utilisation as the case may be.

III. (ii) Andhra Pradesh can withdraw 4 TMC ft for drinking water supply to Hyderabad city from

its proposed Singur project on the Manjra.

III. (iii) Andhra Pradesh can construct the Singur project with a storage capacity of 30 TMC ft. Andhra Pradesh can also use 58 TMC ft under the Nizamsagar project.

IV. Maharashtra has concurred with the arrangements arrived at between Andhra Pradesh and Karnataka in regard to the use proposed by Karnataka in the Manjra sub-basin upstream of the Nizamsagar dam site.

V. Maharashtra and Andhra Pradesh will be free to use an additional 300 TMC ft of water each below the Pochampad dam site for new projects.

VI. Maharashtra and Andhra Pradesh have agreed in principle to the taking up of the Inchampalli project with an FRL as commonly agreed to by the interested States, Maharashtra, Andhra Pradesh and Madhya Pradesh.

VII. Maharashtra and Andhra Pradesh have agreed to take up the following joint projects at the appropriate time with agreed utilisation: Lendi project, Lower Penganga project, and Pranhita project and to set up joint committees for this purpose.

The highlights of the projects agreed to by Andhra Pradesh and Madhya Pradesh are:

I. Madhya Pradesh and Andhra Pradesh will be free to use an additional gross quantity of 300 TMC ft each, out of the water in the Godavari river and its tributaries below the Pochampad dam site for new projects.

II. Madhya Pradesh concurs generally with the agreement arrived at between Andhra Pradesh and Maharashtra. The quantity of 300 TMC ft mentioned in clause I above will not be in addition to 300 TMC ft agreed to between Andhra Pradesh and Maharashtra.

III. In agreeing to 300 TMC ft referred to in paras I and II above, for Andhra Pradesh, Madhya Pradesh on its part has taken into account the estimated requirements within the basin only.

IV. Madhya Pradesh and Andhra Pradesh have agreed in principle to the taking up of the Inchampalli project with an FRL as commonly agreed to by the interested States—Maharashtra, Andhra Pradesh and Madhya Pradesh.

V. It has also been agreed that Madhya Pradesh and Andhra Pradesh will consider taking up the Inchampalli project as a joint project with costs and benefits equitably shared amongst

the above three States in accordance with a common agreement.

VI. Madhya Pradesh has agreed to the taking up of the Taliperu project by Andhra Pradesh involving use of five TMC ft water out of the 30 TMC ft agreed to in clause I and to submersion of the river bed only in Madhya Pradesh. Andhra Pradesh agrees to put up at its cost such protective measures as would be necessary in consultation with Madhya Pradesh to prevent submersion of other areas in Madhya Pradesh.

The highlights of the projects agreed to by Andhra Pradesh and Karnataka are:

(A) Karnataka may go ahead with the following two projects, and their utilisation will be as indicated against each:—(i) Karanja project 13.10 TMC ft and (ii) Chulkinala project 1 TMC ft.

(B) Andhra Pradesh may go ahead with the construction of a reservoir at Singur for the withdrawal of four TMC ft for supplying drinking water to Hyderabad city.

Andhra Pradesh proposes to construct a reservoir at Singur with a capacity of 300 TMC ft and that it may involve the submersion of some land in Karnataka State. In that event the details regarding the project, as to the submersible land in Karnataka will be furnished to the Government of Karnataka for its consideration. Karnataka stated that any evaporation loss from the reservoir should come out of the share of Andhra Pradesh.

Inland water transport: Inland water transport plays an important role in the coastal districts of East Godavari, West Godavari, Krishna and parts of Khammam district. The deep canals of the Godavari and the Krishna provide a close navigation network while those rivers are navigable only in their tail reaches. The total length of navigable waterways in the State is about 2,000 km or about 14 per cent of the total inland waterways in the country. It comprises 309 km of river waterways and 1,690 km of canal waterways. The most important navigation canal in the State is the Buckingham Canal which provides a through waterway from Kakinada port in East Godavari district to Madras and beyond in Tamil Nadu. The total length of the canal is 316 km of which 258 km lie in Andhra Pradesh.

Floods: Floods do occur frequently in this State but they do not pose a severe problem. On account of the flat nature of the land and the heavy cyclonic rainfall, the

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the areas of the Krishna and the Godavari face floods periodically. Some rivers pose the problem of floods when they enter the coastal plains from the uplands.

Irrigation: According to the Irrigation Commission (1972), the State has an ultimate irrigation potential of 1.88 lakh hectares which is equivalent to 88 per cent of the net sown area. In 1970-71, 28 per cent of the net sown area received irrigation. Canals and tanks are the major sources of irrigation and irrigate almost four-fifths of the net irrigated area.

The groundwater department of the Government, according to our Secunderabad correspondent, has carried out some need-based surveys in selected parts of the State. It has found that the total annual groundwater potential of 3.3 mhm (million hectare metres), the present exploitation is only about one-third or 1.06 mhm (Table 3). The State Government is aware of the need to harness the balance of about 2.25 mhm of exploitable groundwater potential to bring in at least two million hectares of land under assured irrigation.

Table 3 : Groundwater potential and utilisation

(Million hectare metres)

Region/district				Total recharge	Annual draft	Percentage of utilisation	Utilised potential
Telangana							
Adilabad	..	..	..	1,16,772	19,684	17	97,088
Hyderabad	..	..	..	85,315	25,454	30	59,861
Karimnagar	..	..	..	1,57,315	96,874	62	60,441
Khammam	..	..	..	1,40,326	44,399	32	95,927
Mahbubnagar	..	..	..	1,84,049	39,183	21	1,44,866
Medak	..	..	..	1,06,342	41,349	39	64,993
Nalgonda	..	..	..	2,05,760	48,407	24	1,57,353
Nizamabad	..	..	..	90,467	30,214	33	60,253
Warangal	..	..	..	1,28,321	67,323	52	60,998
Sub-total	..	..	..	12,14,667	4,12,887	34	8,01,780
Coastal Andhra							
East Godavari	..	..	..	2,30,911	61,161	26	1,69,750
Guntur	..	..	..	1,61,145	51,101	32	1,10,044
Krishna	..	..	..	2,27,368	95,221	42	1,32,147
Nellore	..	..	..	1,89,604	50,216	26	1,39,388
Prakasam	..	..	..	1,67,072	28,141	17	1,38,931
Srikakulam	..	..	..	2,04,314	49,562	24	1,54,752
Visakhapatnam	..	..	..	1,50,060	38,466	26	1,11,594
West Godavari	..	..	..	2,27,706	62,673	28	1,65,033
Sub-total	..	..	..	15,58,180	4,36,541	28	11,21,639
Rayalaseema							
Anantapur	..	..	..	1,76,343	54,302	31	1,22,041
Chittoor	..	..	..	1,46,804	80,783	55	66,021
Cuddapah	..	..	..	74,741	54,087	72	20,654
Kurnool	..	..	..	1,41,355	22,732	16	1,18,623
Sub-total	..	..	..	335,39,243	2,11,904	39	3,27,339
Total for the State				33,12,090	10,61,332	32	22,50,758

Table 4 : Major and medium irrigation projects

(Lakh hectares)

Project	Location of project		Ultimate irrigation potential in Andhra Pradesh		
	River	District	Completed	Under execution	Total
Nagarjunasagar	Krishna	Nalgonda	4.3	3.9	8.2
*Godavari Barrage	Godavari	East Godavari	5.4	—	5.4
*Pochampad	Godavari	Nizamabad	—	2.3	2.3
*Tungabhadra	Tungabhadra	Bellary (Karnataka)	1.1	0.4	1.5
*K. C. Canal	Tungabhadra	Kurnool, Cuddapah	1.2	—	1.2
Vamsadhara	Vamsadhara	Srikakulam	—	0.6	0.6
Kaddam	Kaddam	Adilabad	—	0.3	0.3
Medium projects :	Completed	32	..	..	2.8
	Under execution	18			

NOTE : *Data for these projects are as at the end of August 1975. For other projects, the data relate to March-end 1973.

SOURCES : Ministry of Irrigation and Power, *Annual Reports* and other documents.

Major and medium irrigation projects in the State are shown in Table 4. The Chief Minister of the State has announced that about eight lakh hectares will be additionally brought under irrigation in the next three years. Foundation stones have been laid for three major projects, viz., Somasila in

Nellore district and Ravivada and Konam in Visakhapatnam district. The International Development Association has approved a credit of \$45 million (about Rs 34 crores) for the Godavari barrage project. The World Bank has also agreed to provide financial assistance of Rs 150 crores for the completion of the left and right bank canals of the Nagarjunasagar project and the development of its command area.

The canal system and development of the command area of this project has been unduly delayed. This project was almost "a classic example of bad planning", as was said recently by Mr P. N. Haksar, Deputy Chairman of the Planning Commission. Since the canal system and command area development was not taken up along with the construction of the dam, precious money had been locked up in the project and could not be used for irrigation of power (*The Economic Times*, December 4, 1975).

Although, the area irrigated by wells doubled from three lakh hectares in 1950-51 to six lakh hectares in 1970-71, the utilisation accounts for only 34 per cent of the ultimate groundwater potential. Our Secunderabad correspondent has reported that the depth of the groundwater level varies from 3.5 metres in the coastal district of East Godavari to 10.5 metres in Kurnool district of the Rayalaseema region (Table 5).

Drinking water: According to the data collected by our Secunderabad correspondent, out of 27,218 inhabited villages in the State, 419 villages which account for 0.4 per cent of the total rural population do not have adequate

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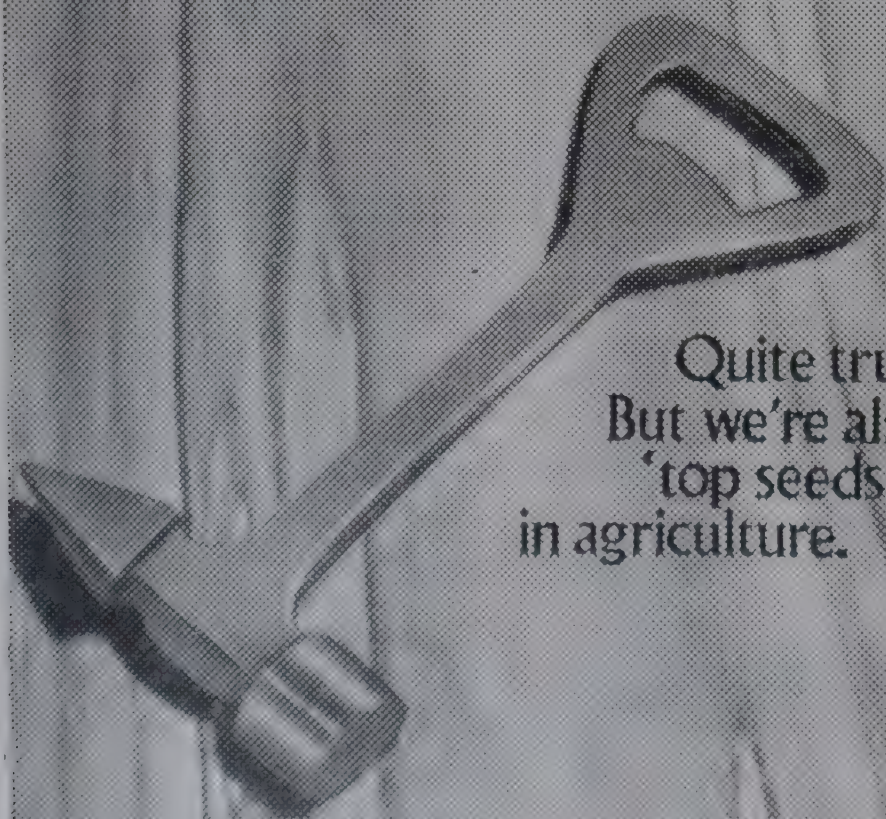


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ing water facilities (Table 6).
 According to an article on "The Pro-
 of Community Water Supply in
 " by Dave J. M., in the *souvenir on*
nar on Water Resources Adminis-
on, Central Water and Power Com-
on, New Delhi, January 1973, out
 e 207 towns in the State, 67 towns
 h account for about 70 per cent of
 State's urban population had been
 ided with water supply up to the
 of 1969.

Pollution: A strange case of
 ution has been reported by Mr Anil
 rwal in *The Hindustan Times* of
 ember 29, 1974. Environmental
 ages caused by the construction of
 Nagarjunasagar dam brought about
 crippling attack of knock-knees
 ase among people living in the com-
 and areas of the dam. The scientists
 the National Institute of Nutrition,
 derabad, believed that the impound-
 water in the reservoir and the canals
 to increase in the level of the sub-
 water in the surrounding areas.
 s increased the fluoride content in
 well waters and also by increasing
 alkalinity of the soil facilitated the
 ake of molybdenum by the jowar
 nts. In the population subsisting on
 ar as staple food, this high level of
 lybdenum intake led to copper de-
 ency. And the entire set of inter-
 ated factors was believed to have led
 knock-knees disease. This case high-
 ights the need for detailed studies of
 e impact of environment before tak-
 g up major irrigation projects.

Table 5: Average depth of groundwater: 1975
 (Metres)

District	Average depth
Adilabad	5.5
Anantapur	6.0
Chittoor	5.5
Cuddapah	6.0
East Godavari	3.5
Guntur	6.0
Hyderabad	7.5
Karimnagar	5.0
Khammam	6.5
Krishna	5.5
Kurnool	10.5
Mahbubnagar	9.0
Medak	6.5
Nalgonda	4.5
Nellore	5.0
Nizamabad	5.0
Prakasam	6.0
Srikakulam	9.0
Visakhapatnam	7.5
Warangal	5.5
West Godavari	3.5

Table 6: Villages without adequate drinking water facility

District	Total number of villages (a)	Population ('000)	Villages without adequate drinking water facilities		Number of villages uninhabited
			Number	Population	
Adilabad	1,709	1,083	7	1,614	153
Anantapur	958	1,739	2	412	28
Chittoor	1,316	1,978	12	2,195	39
Cuddapah	972	1,354	5	2,083	76
East Godavari	1,513	2,494	50	43,672	169
Guntur	716	2,134	2	1,695	28
Hyderabad	1,035	953	1	592	84
Karimnagar	1,087	1,753	2	2,014	36
Khammam	1,226	1,184	18	4,103	126
Krishna	982	1,814	7	9,889	43
Kurnool	918	1,580	13	4,482	20
Mahbubnagar	1,529	1,759	—	—	70
Medak	1,260	1,343	14	6,011	32
Nalgonda	1,165	1,698	4	5,632	50
Nellore	1,099	1,356	9	569	42
Nizamabad	915	1,104	11	4,169	52
Prakasam	1,097	1,707	8	14,465	92
Srikakulam	3,080	2,314	32	11,047	225
Visakhapatnam	4,888	2,180	198	20,789	704
Warangal	1,085	1,620	13	9,676	104
West Godavari	880	1,954	11	3,670	39
Total	29,430	35,101	419	1,48,869	2,212

NOTE: (a) Includes uninhabited villages shown in the last column

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In yet another area, work is on hand to find alternative technologies to reduce the installed cost of coal-based power plants and improve the utilisation of coal through coal gasification and combined cycles.

ESNP has also started a major programme for the continuous monitoring and improvement of conventional power plant performance.

The war of the elements!

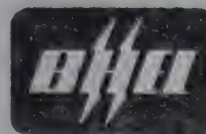
From the sky above to the mud below, the scientists of ESNP are busy seeking non-conventional sources of energy. In the hope

that perhaps one day an entire village may be lit by Solar Energy. Or, fields irrigated by wind power.

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M AND OTHER NORTH EASTERN STATES

Most untapped water sources

the States in the north-eastern region, viz, Assam, Manipur, Megha-Nagaland, Sikkim and Tripura, constitute hydrologically a homogeneous region, generally receive copious rainfall. It would, therefore, seem no irrigation facilities are required in this area. But it is not so. Because of their rugged terrain, most of the rain flows down quickly into the river systems soon after the precipitation.

So, paradoxically enough, if too much of water and even floods pose a serious problem during the monsoon, scarcity of water becomes a problem on the upland and hill slopes during the remaining months. Further, no major irrigation projects could be located in this region because of economic and technical problems. Hence, the irrigation facilities most commonly resorted to are diversion of waters from streams into rivulets through channels, bamboo pipes, small check-dams or lift irriga-

ASSAM

Except the Brahmaputra valley in the north and the Barak valley in the south, there are all around hills covering half the total area of Assam. Notorious droughts but furious floods are a problem to this State with plentiful rainfall and unruly rivers.

Rainfall: The average annual rainfall in Assam is 240 cm (94 inches), which is the third highest among the States after Kerala and Meghalaya. The monsoon here is generally spread over eight months from March to October, but the most distinguishing feature is the copious rains between March and May at a time when the precipitation in upper India is at its minimum. Expectedly, the whole of the net sown area lies under the high rainfall region (150 cm or 45 inches and above). However, the southern flank of the Brahmaputra valley comes, to some extent, under the rain-shadow region of the Meghalaya plateau.

Rivers: The Brahmaputra, one of the longest rivers of the world, traverses the State from east to west for 720 km. A significant characteristic of the Brahmaputra is that the river itself is highly braided necessarily due to its

low gradient. As a result, there are innumerable riverine islands. Majuli (929 sq km) is the largest river island in the world. Also, the river is heavily laden with silt. Its flow is so sluggish that even the smallest obstruction may lead to the formation of an almond-shaped bank which, with the next flood, may be entirely washed away. In the rainy season, the river resembles a "slowly moving lake," in parts being as wide as 8 km from bank to bank.

According to the Irrigation Commission (1972), the average annual run-off of the Brahmaputra at Pandu in Kamrup district is of the order of 4,87,225 million cubic metres (m. cu. m.). Adding to this the run-off of the principal tributaries downstream of Pandu, the run-off of the whole Brahmaputra river system in Assam may be taken to be 5,58,766 m. cu. m.

The Brahmaputra valley is almost a flat level plain. There is a marked difference between the north and south banks of the river. In the north, in all 25 tributaries, running down from Arunachal Pradesh and Bhutan debouch abruptly to the main valley and form a series of alluvial fans which obstruct the course of these tributaries near the foothills. As a result, the rivers branch

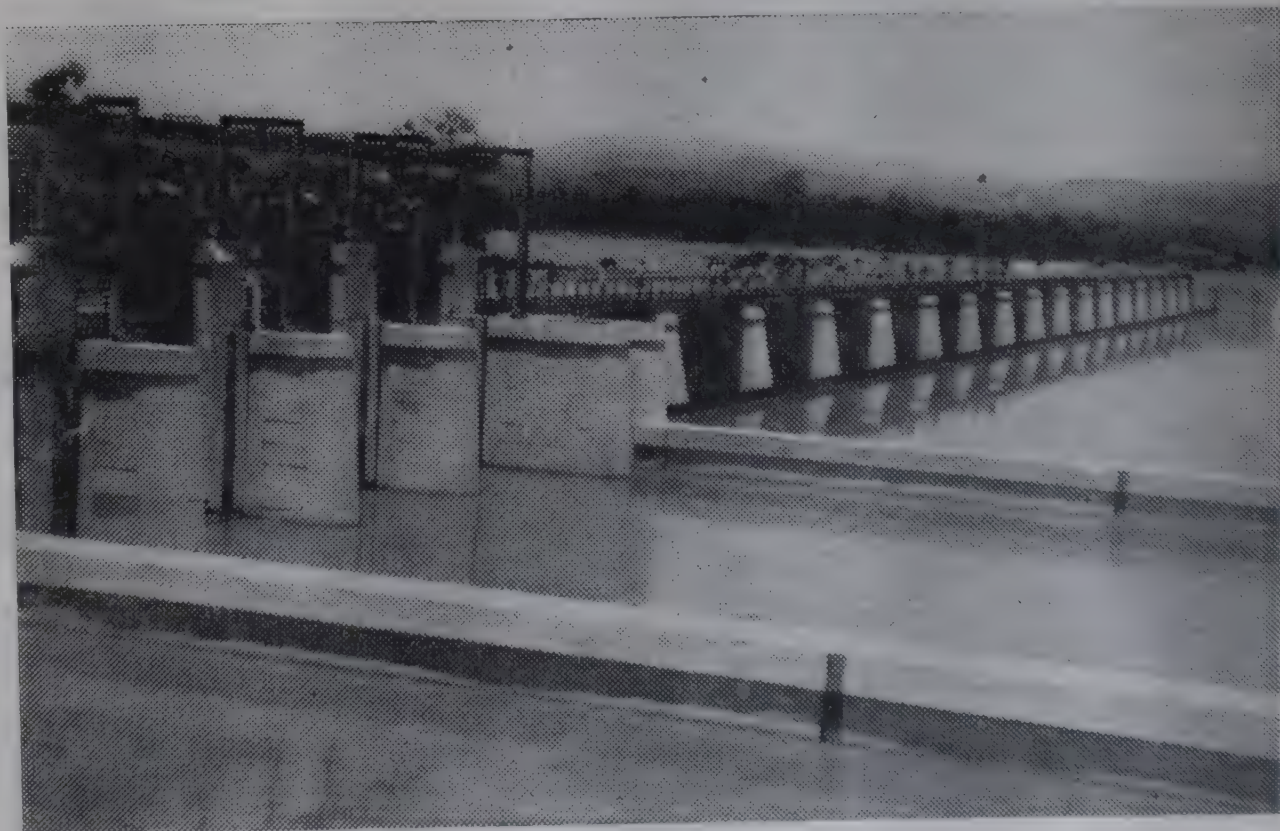
out in different channels till they form permanent courses further downstream.

Before finding their way into the Brahmaputra these rivers almost run in a parallel course. Consequently, the tributaries have conspicuous meandering courses leading to the formation of beels, ox-bow lakes and huge marshy tracts. Some of the important among those tributaries are the Subansiri, the Dikrang, the Kameng and the Manas. The southern part of the valley is less wide and uneven, and the tributaries in the south-east are considerably larger. The western section of this valley is very narrow with small tributaries which run in less meandering courses. Important among the 15 southern tributaries are the Burhi-Dehing, the Kopili, the Dhansiri, the Kulang and the Khri.

The Barak river which rises in Manipur flows through the Cachar district of Assam. Some of its principal tributaries within Assam are the Sonai, the Dholeswari and the Lengai. The annual run-off of the Barak and its tributaries within Assam is 32,677 m. cu. m.

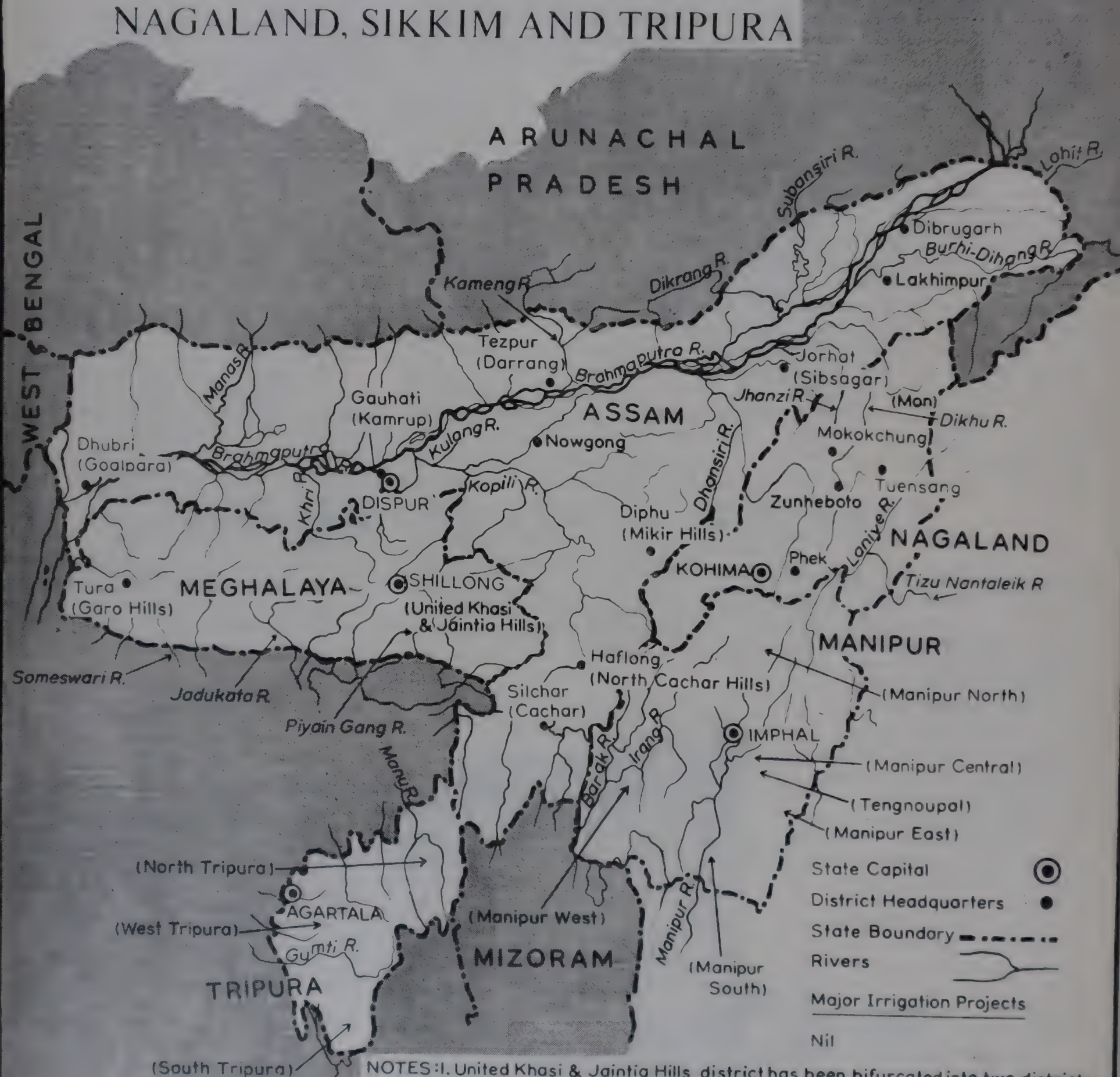
The rivers, particularly the northern ones, with severe drops during their courses, offer tremendous hydro-power potential. The Energy Survey of India Committee has estimated the State's potential (including Meghalaya) at 12 million kw or about 30 per cent of the country's total potential, which is the highest among all the States.

Floods: There is hardly any other part in the country which is hit by severe floods as frequently as Assam. The mighty Brahmaputra, with its turbulent tributaries, inundates vast tracts



Jamuna Irrigation Project, Bokolia (Mikir hills), Assam

RIVER SYSTEM OF ASSAM, MANIPUR, MEGHALAYA NAGALAND, SIKKIM AND TRIPURA



NOTES: 1. United Khasi & Jaintia Hills district has been bifurcated into two districts, viz., Khasi Hills & Jaintia Hills

2. District name appears in bracket where it differs from the name of the headquarters centre

3. For Sikkim, see West Bengal map.

4. Illustration not to scale

ally every year. The Brahmaputra is very narrow with an average width of 80 km or so, of which the river occupies a width of 6 to 10 km at many places. The river with its tributaries carries a tremendous volume of water and considerable silt discharge during the rains, when the heavy monsoon downpour in their catchment areas is supplemented by the melting of snow in their Himalayan sections. As a result, the rivers get choked up with silt. Active bank erosion also results in filling the beds and thus the river holding capacities diminish. These hydrological conditions naturally result in the swelling of the rivers causing floods. In addition to these normal processes, natural calamities like earthquakes sometimes disturb the natural course of the rivers and create additional forces for flooding.

Navigable waterways: When calmed during the post-monsoon season, some of the rivers are navigable and the State possesses the second longest river waterways (1,983 km) in the country after Uttar Pradesh (2,268 km).

Groundwater: According to the information obtained by our correspondent from official sources, the average rainfall brings in 17.5 million hectare metres of water. But most of the precipitation is diverted through surface runoff and evapo-transpiration before it recharges the groundwater resources. Due to lack of systematic data on this, it can be assumed that only 10 per cent of the total average rainfall, i.e., 1.75 million hectare metres, reaches the sub-surface level.

As can be seen from the data collected by our correspondent, the average depth of groundwater in the different districts varies between 10 to 15 feet and 80 to 120 feet (Table 1). He further reports that at present the efforts to develop groundwater are negligible.

Table 1: Average depth of groundwater in Assam

District	Average depth of groundwater in feet in 1975
Lakhimpur and northern parts of Darrang ..	80 to 120
Darrang ..	20 to 30
North Cachar and Mikir Hills ..	30 to 40
Sibsagar ..	15 to 20
Nowgong ..	15 to 20
Cachar ..	15 to 20
Kamrup ..	15 to 20
Dibrugarh ..	10 to 15
Goalpara ..	10 to 15

The number of heavy duty tubewells (yielding 1,500 litres per minute) is not more than 150. While the number of medium and light duty tubewells (200 to 500 litres per minute) might not exceed even 900, the open dug wells (10 to 50 litres per minute) would number about 5,000. The State has taken steps for the development of groundwater.

A scientific evaluation of groundwater potentiality and hydrological surveys are being carried out by the Directorate of Geology and Mining. Besides, the Central Groundwater Board is also engaged in similar studies. A State groundwater co-ordination committee has been formed to formulate general programmes and co-ordinate groundwater development activities. During the Fifth Plan, the target of drilling in Assam has been fixed at 19,000 running metres and 450 tubewells. Of this, 8,417 running metres of drilling has already been completed and 23 tubewells constructed.

Table 2: Villages without adequate drinking water facilities in Assam: 1972

District	Total number of villages	Villages without adequate drinking water facilities
Cachar ..	2,413	562
Darrang ..	2,538	382
Dibrugarh } ..	3,844	1,205
Lakhimpur }		
Goalpara ..	3,819	1,022
Kamrup ..	3,144	618
Mikir Hills ..	1,451	634
North Cachar Hills	480	257
Nowgong ..	1,961	395
Sibsagar ..	2,345	654
Total ..	21,995	5,729

Irrigation: Although, as mentioned earlier, the State receives heavy rainfall, the water flows down the valleys. Hence, it is necessary to conserve the rain water and provide irrigation on the hill slopes in the off-season. During 1970-71, one-fourth of the net sown area benefited from irrigation facilities—mainly through private canals. There are two completed medium irrigation schemes, and three are under implementation. Of the total surface water irrigation facilities created through medium projects, nearly half were utilised in 1974-75.

Drinking water: As per the information based on the survey conducted by the Directorate of Statistics of Assam, nearly one-fourth of the total villages in the State did not have adequate drinking water facilities in 1972 (Table 2). The Department of Public Health Engineering has fixed a target of

providing drinking water facilities to 5,500 villages during the Fifth Plan.

The water-bearing strata vary from 40 to 300 feet. At the foothills, hard rocks are encountered, and the water level is mostly below 100 feet. The water available on the topmost water-bearing strata is not potable due to its excessive iron content. Surface water sources are located at considerable distance. Hence, though Assam receives heavy rainfall, paradoxically, there is an acute shortage of drinking water.

MANIPUR

Situated among the eastern offshoots of the Himalayas, Manipur, the land of the classical Manipuri dance, has a rectangular vessel-like surface; the fertile valley in the centre is surrounded by hills on the four sides. Waters of the rivers and also rainfall are yet to be adequately harnessed.

Rainfall: On an average, the State receives a fairly high rainfall of 193 cm (76 inches). All the net sown area falls under the high rainfall region (115 cm or 45 inches and above).

Rivers: The Barak, the Irang and the Manipur are major perennial rivers. The southern part of the central valley has many lakes of which, the Loktak is the biggest.

Irrigation: Though the precipitation is heavy and generally meets the crop requirements the variations from year to year give rise to the need for irrigation. As per the data collected by our Imphal correspondent, the surface water available mostly from rains comes to about 30 lakh acre feet. During 1970-71, one-third of the net sown area received irrigation. Water for irrigation is generally diverted from the streams on the hill slopes. Work on the first major project—the Rs 21-crore Loktak project—is in progress. On completion, it is expected to irrigate about 24,000 hectares of land. Besides, 23 minor schemes at a cost of Rs 16 lakhs are in various stages of implementation and planning. These together would irrigate about 10,000 hectares.

Our Imphal correspondent has sent an interesting success story of water use for agriculture. Some 13 tribal villages in West Manipur district were chronically short of food. However, two pumps were installed to provide water from the Manchudui stream to these fields. And within a year the picture changed. Not only has the food deficit been wiped out but now they also claim to have a small surplus.

Groundwater: Our correspondent reports that the search for groundwater

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as undertaken around Imphal in 1971. Drilling at five places revealed that at two places the groundwater was struck at a depth of 106 metres and at 150 metres in the three other places. But the quantity of water was insufficient to exploit in a big way.

Drinking water: The data collected by our correspondent reveal that out of the total 1,969 villages, only two villages have adequate drinking water. As for towns, only three of the eight towns have this facility.

MEGHALAYA

Meghalaya stands high to the south of the Brahmaputra valley. It is a tableland which is the eastward extension of the massive block of the Indian peninsular shield. So, it has a rugged topography. Rains never fail in Meghalaya—the abode of clouds—but very often men do!

Rainfall: The State receives copious rainfall of 241 cm (95 inches) per annum. The high precipitation is due to the fact that the south-west monsoon laden with a great amount of moisture from the Bay of Bengal passes over Bangladesh and is suddenly obstructed by the cliffs of this tableland. Further to the north, the rainfall decreases due to significant rain-shadow effect. So, the average rainfall varies from 308 cm in the south to 127 cm in the north. Cherapunji, a place in the south-east, receives 1,087 cm (428 inches) of precipitation, one of the highest rainfalls in the world.

Rivers: The rivers in the western part of the State make two distinct systems separated by the central Tura Range, one flowing to the north towards the Brahmaputra and the other to the south to the Surma river in Bangladesh. The important north-flowing rivers are the Kalu, the Ringgi, the Chagua, the Ajagar, the Didram, the Krishnai, and the Daudhani. The important rivers of the southern system are the Darong, the Sanda, the Bandra, the Bhogai, the Dareng and the Someswari.

The drainage system of the eastern part is characterised by a radial pattern as rivers emanate from the dome-shaped central portion of the hill range on the easternmost side. The main systems are those of the Dhansiri and the Jamnua.

Irrigation: Lift irrigation and diversion of water from streams through bamboo pipes are some of the common irrigation methods relied upon. At the end of 1970-71, 23 per cent of the net sown area was receiving irrigation.



Irrigation channels in the midst of paddy fields in Jiribum area, Manipur.

Groundwater: Survey work on estimating the groundwater potential has just begun with the help of the North Eastern Council. Our Shillong correspondent reports that the average depth of groundwater is 5.5 metres in Jaintia Hills district, 6.7 metres in Garo Hills district and 6.8 metres in Khasi Hills district.

Drinking water: The data collected by our Shillong correspondent from reliable sources on rural drinking water supply are presented in Table 3. About two-thirds of the total rural population does not have adequate drinking water facilities. One commendable feature of

the rural water supply schemes implemented so far, however, is that the people have the benefit of filtered and treated water with street taps near the door-steps and in some cases even inside their houses.

The Public Health Engineering Department, our Shillong correspondent informs, is implementing 47 rural water supply schemes. In drawing up such schemes, high priority is given to the villages having no water sources within a radius of one km and the hilly areas which are chronically at a disadvantage in respect of water supply. Out of 4,629 villages, as many as 3,732 are



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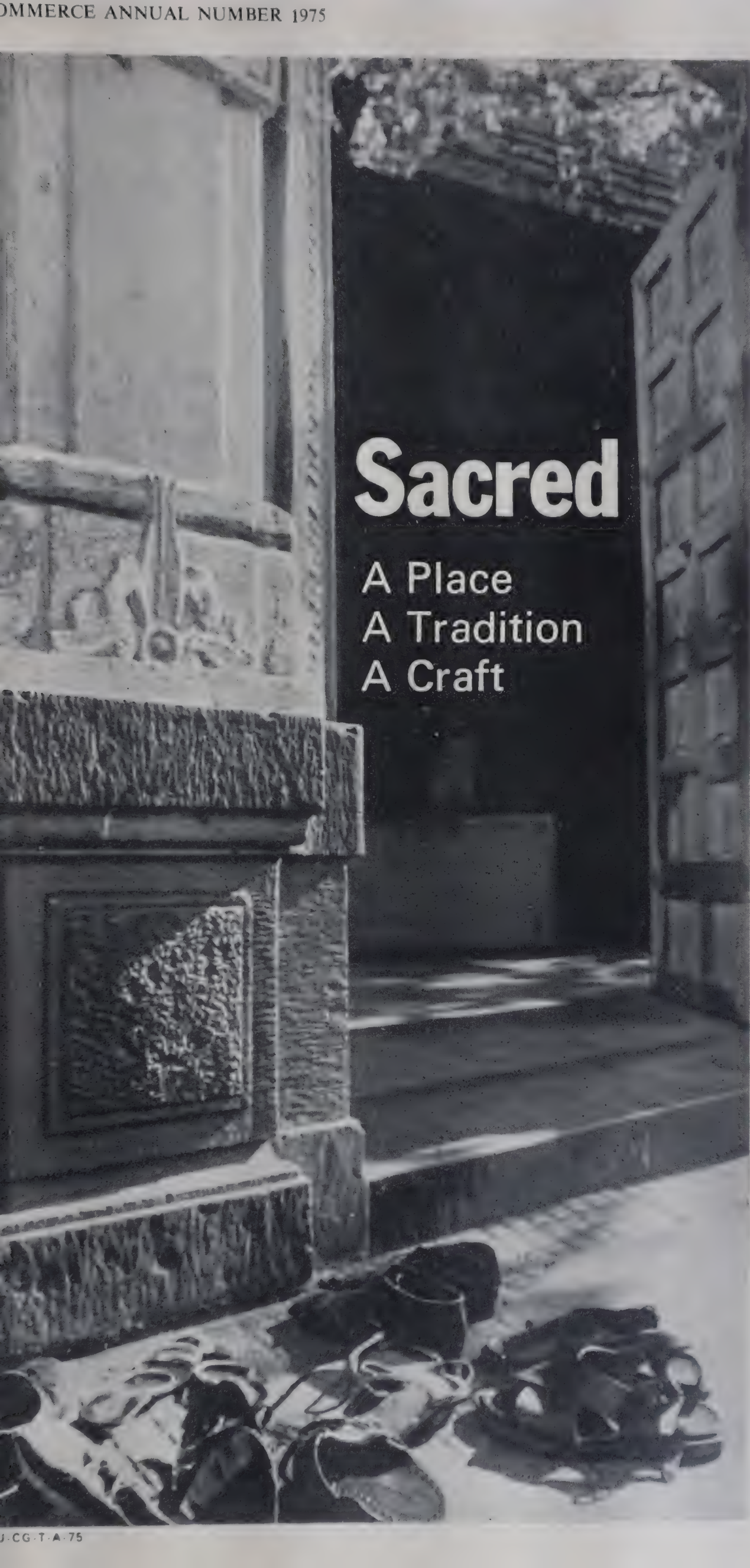
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*I grew up untutored,
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*But my syncopated sitar
has driven nations to frenzy.*

*I am surrounded by children
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*But I have given man
his first philosophy.*

*I craft shoes that shod
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*But I have just begun
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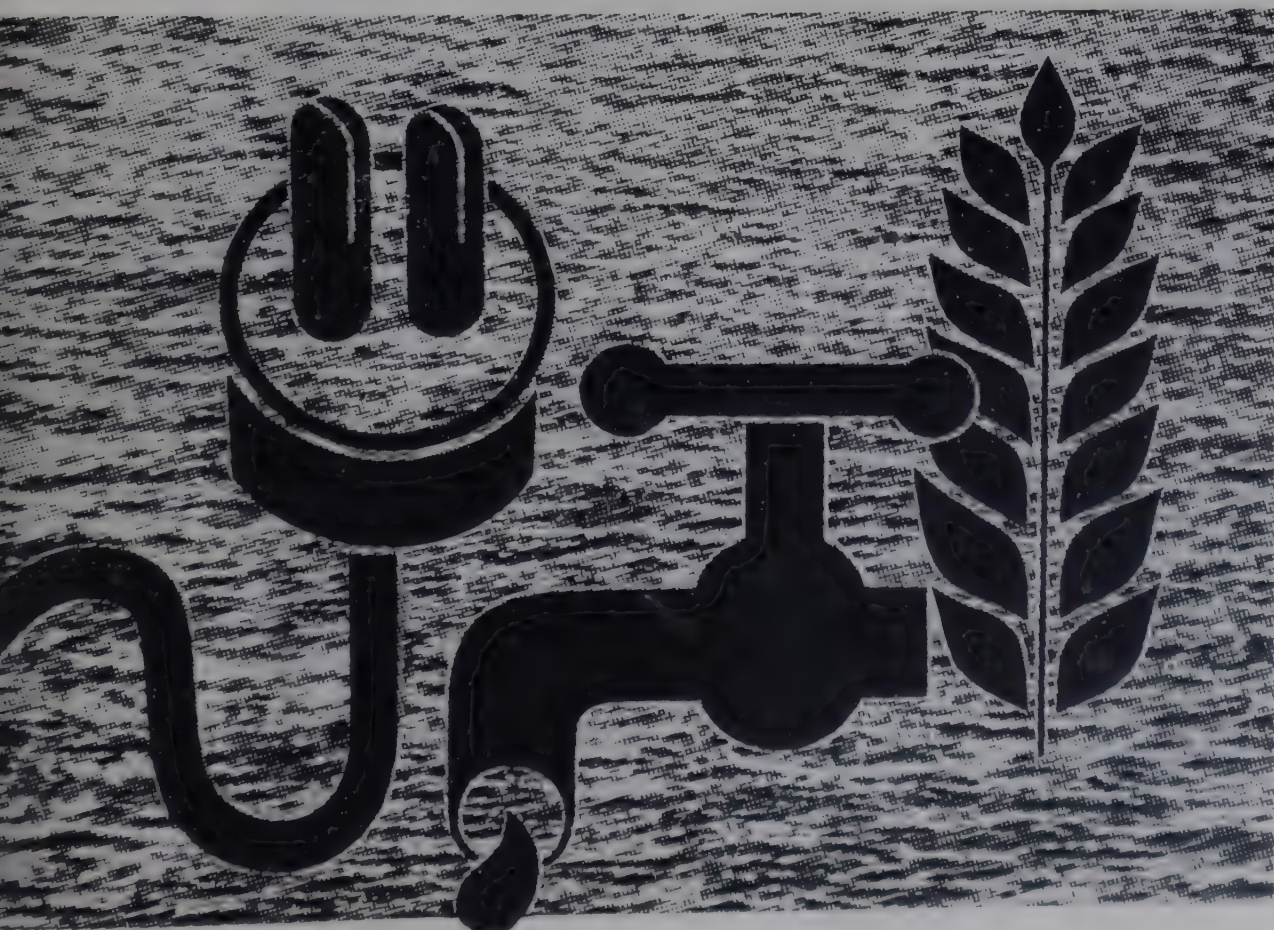
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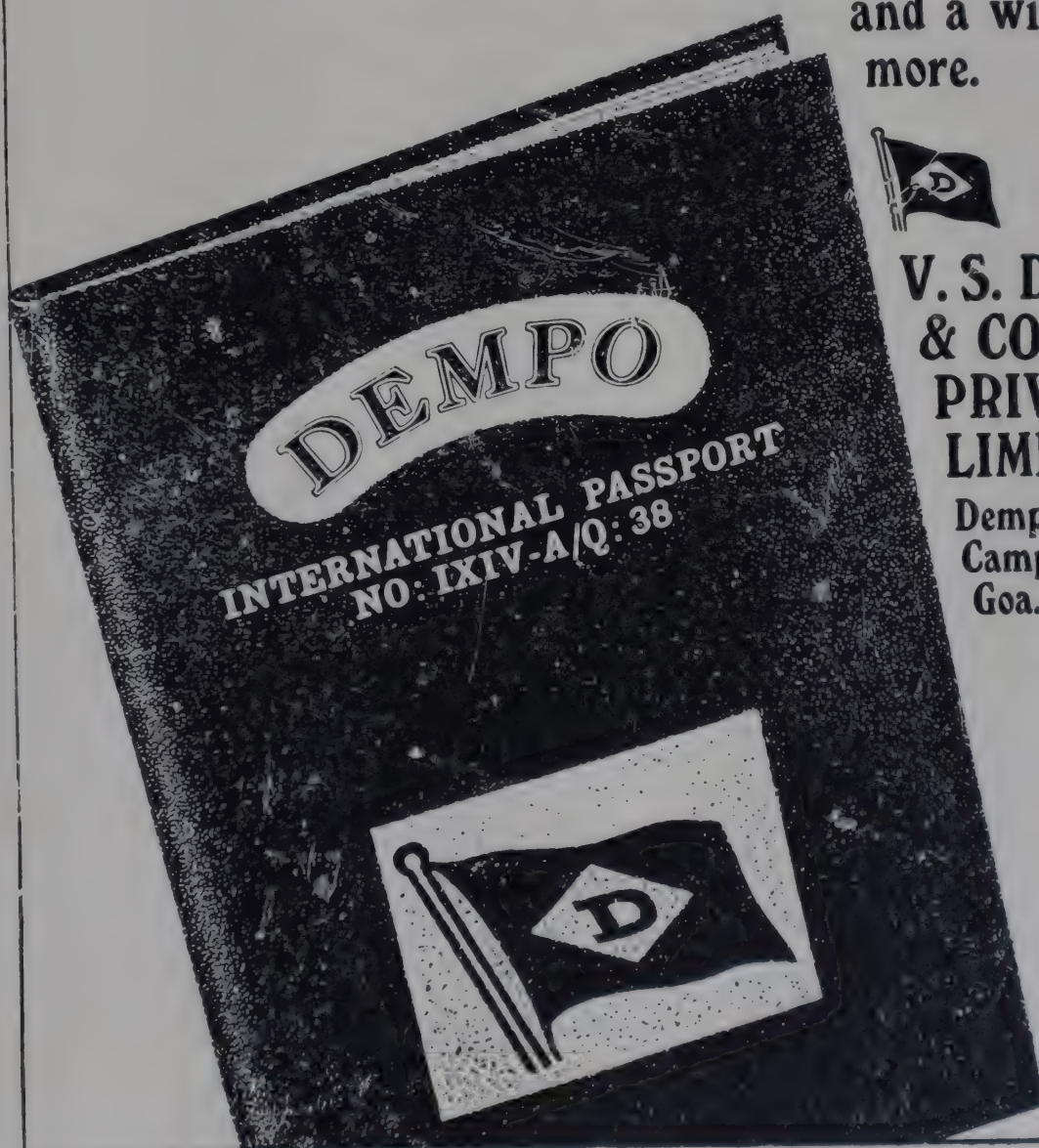
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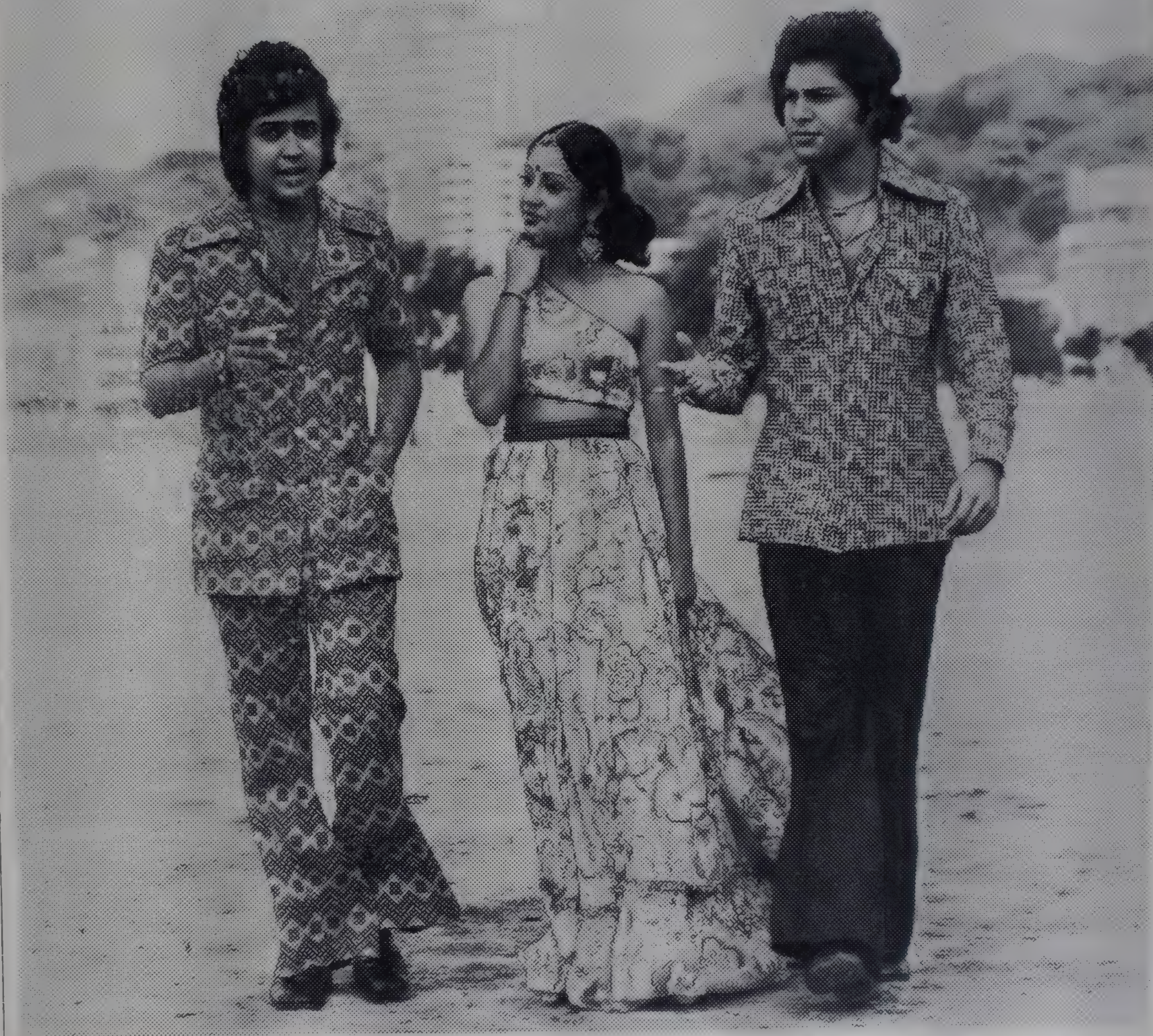
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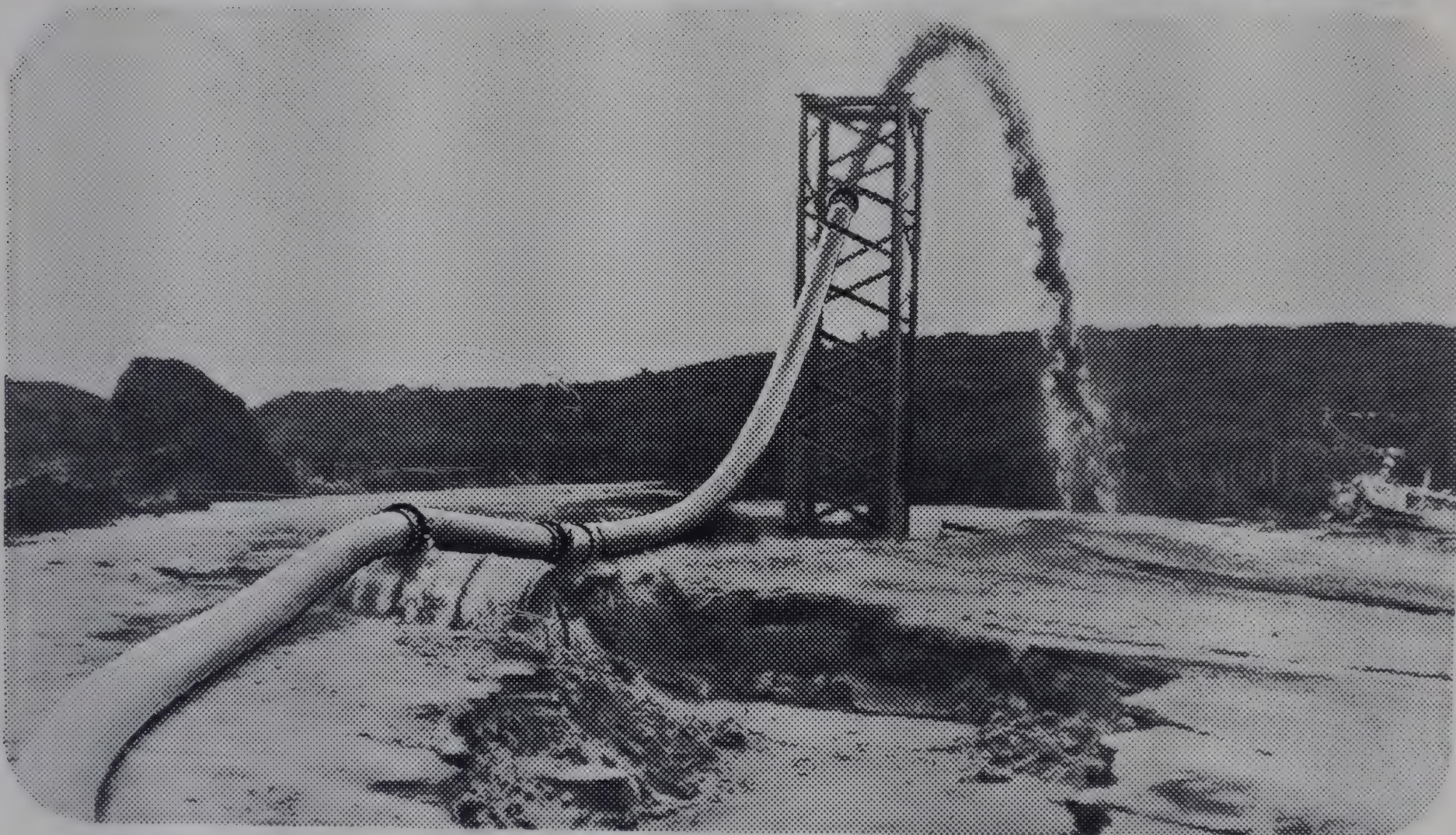
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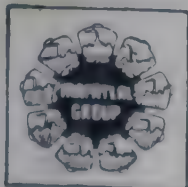
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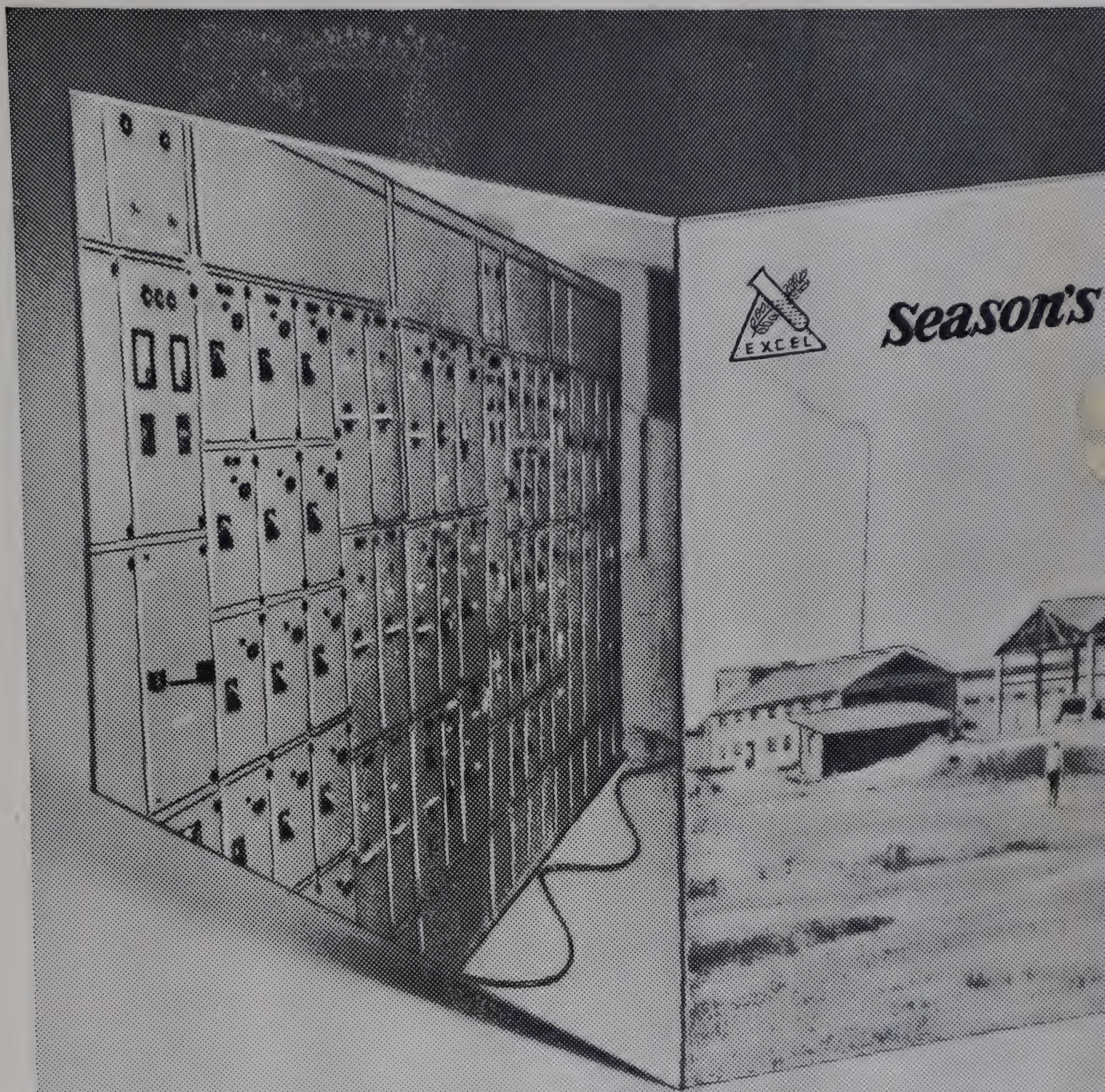
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Table 3 : Villages without adequate drinking water facilities

District	Total number of villages	Population ('000)	Villages without adequate drinking water facilities		
			Number	Population	
				'000	As per cent of total rural population
Garo Hills	2,350	391	2,312	241	62
Khasi Hills	1,867	368	1,821	244	66
Jaintia Hills	412	105	389	90	86
Total	4,629	864	4,522	575	67

classified as "no source villages". It is proposed to cover 620 such villages with a population of 2.4 lakhs during the Fifth Plan.

NAGALAND

Nearly three-fourths of Nagaland, situated strategically in the north-east, is composed of hilly terrain occasionally covered with evergreen forests. One of the most scantily populated States, Nagaland is almost entirely rural and tribal. Villages are perched on hill-tops, while the valley flanks are stepped here and there with flights of paddy terraces.

Rainfall: This State of the north-east region also receives heavy average rainfall of 193 cm (76 inches) per annum, occurring mostly between April and October. It ranges between 177 cm (70 inches) in the western parts and 254 cm (100 inches) in the eastern parts. As per the data sent by our Kohima correspondent the rainfall brings in water of about 5,000 crore gallons, of which 500 crore gallons are lost through seepage. The consumption for irrigation is 1.5 crore gallons, and human consumption is 1.5 lakh gallons.

Rivers: Major rivers of the State are the Dikhu, the Janzi, the Tizu, Nantaleik and the Laniye.

Irrigation: The Irrigation Commission (1972) has placed the ultimate irrigation potential from surface as well as groundwater at 50,000 hectares, which can irrigate about half of the net sown area. But, as in 1970-71, only one-eighth of the net cultivated land received irrigation. Because of mountainous topography, there are no major or medium irrigation projects. Irrigation is generally provided by: (a) contour channels from hill streams at higher altitudes; (b) contour channels leading from small reservoirs or small dams over streams; and (c) lift irrigation from rivers.

Drinking water: Turning to drinking water supply, our Kohima corres-

pondent reports that it has not been possible to supply tap water to the villages as yet. However, the Government has constructed new wells in about 60 per cent of the villages at places where water comes from the hills for drinking purposes.

No information is available on drinking water supply to its three urban centres—Kohima, Mokokchung and Tuensang—which account for a tenth of the State's total population.

SIKKIM

Sikkim, the smallest and the most sparsely populated State of India, is situated in the extremely mountainous region of the eastern Himalayas where is located the mysterious and majestic Kanchanganga (8,579 metres), the world's third highest mountain peak, which is also described as "climbed but virgin still." Dense forests including tropical vegetation spread over about a third of the State's area.

Rainfall: The annual rainfall in the State is reported by our Gangtok correspondent to be about 355 cm (140 inches), which can be regarded as the highest among all the States. There is a contrast in rainfall between the sheltered villages, the foot-hills and the mountain tops. The pre-monsoon showers begin towards the end of March, the proper monsoon lasting from May to the end of September. But as most of the precipitation flows down the hill slopes, the available soil moisture is not adequate to meet all the needs in the winter and the summer. The failure of rains is an uncommon feature. Even then, sometimes the rains fail. In 1975, for instance, the south and west Sikkim districts had scanty rainfalls, which resulted in drought in those areas.

Rivers: Sikkim is traversed by snow-fed perennial rivers, important among them being the Tista, the Rangpo and the Rangit. But the rivers flow through deep and steep valleys full of boulders; hence the scope for using

their water is limited. At the most they can be used for timber floating. However, they offer tremendous scope for power generation.

Irrigation: The total cultivated area is estimated to be about one lakh hectares. Of this, nearly 11 thousand hectares or 11 per cent are having irrigational facilities. Irrigation is provided mainly by tapping the streams on the hill slopes.

Our Gangtok correspondent informs that no specific estimates of the total quantity of water needed for irrigation and for drinking are available. A master plan for rural development is under preparation. On its completion by the end of March 1976, the requirements will be known.

Drinking water: As for rural drinking water supply, the data furnished by our Gangtok correspondent reveal that so far 730 drinking water supply schemes have been implemented which have benefited about a third of the total rural population. The Government is making every possible effort to cover all the villages so that every individual may get water within a radius of half a mile. Polythene pipes are used for supply of drinking water as well as for irrigation. Gangtok, the capital, has been provided with a water supply scheme. Within a year or so, 18 other urban areas are proposed to be covered.

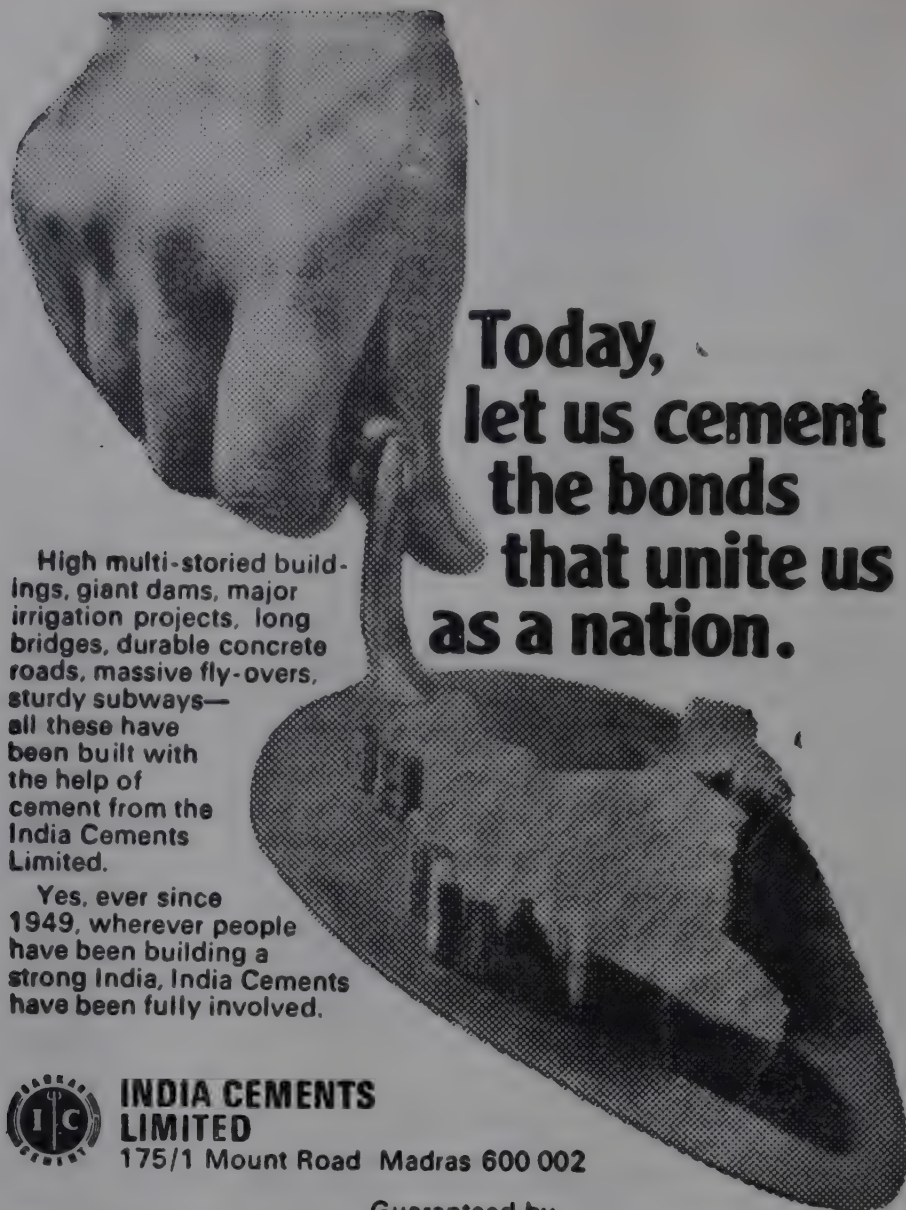
TRIPURA

Intersected by seven hill ranges with valleys in between, the physiography of Tripura is extremely uneven and forested. The lowlands interspersed with hillocks are very fertile. Abundant rainfall and highlands offer also good scope for the development of horticulture.

On the whole, Tripura receives an average annual rainfall of 193 cm (76 inches). Besides, the State is drained by eight rivers, namely, the Dolai, the Marue, the Juri, the Laugai, the Humti, the Fenny, the Manu and the Muhari.

Due to difficult terrain, irrigation facilities are inadequate. In 1970-71, only 9 per cent of the net sown area received irrigation. Most of the irrigation is from diversion works, whereby water from hill streams or rivulets is diverted to nearby fields by constructing temporary earthen dams. Well irrigation is hardly practised, while tank irrigation is highly limited.

Nevertheless, double cropping is widely practised in the State as it receives fairly good rains during the months of March and May, this facilitates the raising of summer crops.



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AR

Man-made floods and droughts?

NOT that Bihar is short of water; there is plenty of it. But the maldistribution of the ample water resources leads on the one hand to floods and on the other hand to droughts. Mostly this is due to the failure of man to take adequate measures for water conservation but to a much larger extent it is due to the reckless destruction of forests.

Rainfall: On an average, the State receives rainfall of 132 cm (52 inches) per annum, mostly from the south-west monsoon. But the late September-October rains, locally known as 'Hathia', are crucial for agricultural production though the precipitation is barely 5 cm to 10 cm (2 to 4 inches). The rainfall varies from 136 cm (54 inches) in the plateau region in the south to 122 cm (48 inches) in the plains in the north. About four-fifths of the net sown area in Bihar falls under the high rainfall region (above 115 cm or 45 inches) and the rest under the medium rainfall regions (75 cm to 115 cm or 30 to 45 inches).

Drought-prone areas: The Irrigation Commission (1972) has not identified any part of the State as a drought-affected area. But there are, broadly, two pockets which are particularly vulnerable to drought, mainly due to failure of timely rains—one comprising parts of Bhagalpur, Santal Parganas and Buxar districts on the plateau and the other covering parts of Patna, Gaya, Saran and Shahabad districts in the southern Ganga plains.

Rivers: The Ganga is the most important river and flows from west to east. In its course it is joined by several rivers from north as well as south. The northern rivers are snow-fed and have their origin in the glacial regions of the Himalayas. Important among them are the Ghaghara, the Gandak, the Burhi Gandak, the Bagmati, the Kamala, the Kosi and the Mahananda. From the south, the Son with its tributary—the North Koel—joins the Ganga. Other important rivers are the Damodar, the Barakar, the Badua, the Chandan, the Ajoy and the Sankh. The Bihar State Irrigation Commission has made an assessment of the water resources of these rivers in the State at 60,000 million cubic metres (Table 1).

The State has nearly 1,200 km of inland waterways, comprising 937 km of river and 325 km of canal waterways. The Ganga is again the most important river in this respect. According to Mr Uma Shankar Dikshit, former Union Minister for Shipping and Transport, the Ganga-Bhagirathi-Hooghly river system is scheduled to be declared a national

Table 1 : River water resources in Bihar

	Million cubic metres
North Bihar rivers	17,762
South Bihar rivers	18,242
Chotanagpur and Santal Parganas rivers	24,078
Total	60,072

SOURCE : Government of India, Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 57.

waterway (*Bhagirath*, July 1975). An experimental-cum-promotional river transport service has been operating since 1971 on the Ganga between Patna and Chunar in Mirzapur district of Uttar Pradesh as a forerunner of a long-distance service between Calcutta and Allahabad.

Floods: The rivers in the northern Ganga plains, particularly the Ghaghara, the Gandak and the Kosi, which

originate from the Himalayas, are often in spate in the monsoon due to simultaneous snow-melting and heavy rainfall and cause widespread devastation and loss to life and property. The Kosi river, which quite frequently changes its course is, in fact, called "the river of sorrow of Bihar".

Apart from the tributaries, the main Ganga also spills over its banks and causes considerable damage. Moreover, the floods in the Ganga cause backing up action in all its tributaries. Worse conditions occur when the floods in the Ganga and its tributaries synchronise. Even in south Bihar some rivers like the Badua, the Chandan, the Koel and the Son are occasionally flooded.

By September 1972, flood protection embankments of a length of 2,655 km have been constructed providing protection to 24 lakh hectares, while schemes for 472-km embankments to protect four lakh hectares are continuing. The Government proposes to take up the construction of 1,806 km of embankments to protect 37 lakh hectares of land. According to the latest available official estimates, the floods during the monsoon of 1975 affected more than 13 million people and damaged property and crops worth Rs 600 crores.

Groundwater resources: No systematic study of the availability of groundwater in the State seems to have been carried out so far. However, the Irrigation Commission (1972) has reported that the net annual recharge of groundwater in Bihar is of the order of 22 million acre feet. By the end of 1967-68, the annual draft was only two million acre feet. Thus 20 million acre feet of groundwater was annually available for further development. As mentioned by Mr S. N. Ray, the Chief Engineer (Irrigation) of the State, in

Table 2 : Distribution of culturable area according to groundwater yields
('000 hectares)

Description	Northern Ganga plains	Southern Ganga plains and the plateau	Total	Per cent
High yielding area (Yield : 90,000 litres or more per hour) ..	5,464	901	6,365	37
Moderate yielding area (Yield : 20,000 to 90,000 litres per hour) ..	13	252	265	1
Low yielding area (Yield : Below 20,000 litres per hour) ..	—	796	796	5
Rocky belt	142	9,837	9,979	57
Total	5,619	11,786	17,405	100

SOURCE : Government of India, Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 57.

RIVER SYSTEM OF BIHAR



article "Water Resources Development in Bihar" (*Souvenir, Seminar on Water Resources Administration*) the potential from groundwater resources, considering the recharge and operations, would be 27,124 m.c.u.m.

The distribution of culturable area according to groundwater yields (based on the index maps prepared by the Bihar State Irrigation Commission) is given in Table 2. As can be seen from the table, more than half of the culturable area comes under the rocky region. In the northern Ganga plains, however, almost all the culturable

Table 3 : Average depth of groundwater : 1975

District	Average depth of groundwater (Metres)
Aurangabad	4.32 to 11.66
Begusarai	4.00 to 6.00
Bhagalpur	2.85 to 8.80
Bhojpur	2.40 to 9.87
Darbhanga	2.54 to 6.30
Dhanbad	3.78 to 5.80
East Champaran	3.30 to 7.05
Gaya	4.39 to 8.81
Giridih	6.10 to 11.30
Gopalganj	1.94 to 5.17
Hazaribagh	6.00 to 11.00
Katihar	3.20 to 5.40
Madhubani	1.50 to 4.00
Monghyr	2.85 to 11.70
Muzaffarpur	3.59 to 7.99
Nalanda	3.87 to 8.77
Nawada	2.75 to 5.62
Palamau	3.21 to 14.87
Patna	3.34 to 8.26
Purnea	2.90 to 4.17
Ranchi	6.70 to 11.70
Rohtas	4.72 to 10.32
Saharsa	9.90 to 14.70
Samastipur	4.03 to 6.87
Santal Parganas	5.20 to 11.70
Saran	3.04 to 4.90
Singhbhum	15.80 to 21.70
Sitamarhi	2.80 to 5.00
Siwan	2.89 to 5.00
Vaishali	3.90 to 6.30
West Champaran	2.64 to 5.99

area falls under the high groundwater yielding region.

The average depth of groundwater in districts as based on official data collected by our Patna correspondent is given in Table 3.

Irrigation: According to the Irrigation Commission (1972) the State has an ultimate irrigation potential of 80 lakh hectares, which is equivalent to 95 per cent of the net sown area. However, in 1970-71, 27 per cent of the net sown area received

Table 4 : Major and medium irrigation projects : Bihar

(Lakh hectares)

Project	Location of project		Ultimate irrigation potential in Bihar		
	River	District	Completed	Under execution	Total
*Gandak	Gandak	Champaran	4.1	7.4	11.5
*Kosi	Kosi	Saharsa	3.0	1.3	4.3
*Son	Son	Rohtas	0.9	0.7	1.6
*Bhagmati Barrage	Bagmati	..	..	1.0	1.0
Badua	Badua	Bhagalpur	0.4	..	0.4
Chandan	Chandan	Bhagalpur	..	0.4	0.4
Medium projects :	Completed	34	..	..	5.0
	Under execution	15			

NOTE : *Data for these projects are as at the end of August 1975. For other projects, the data relate to March-end 1973.

SOURCES : Ministry of Irrigation and Power, **Annual Reports** and other documents.

Table 5 : Villages without adequate drinking water facility

District	Total number of villages in the district	Population ('000)	Villages without adequate drinking water facilities	
			Number	Population
Aurangabad	2,397	1,242	205	83
Begusarai	692	1,042	66	45
Bhagalpur	2,552	1,869	246	69
Bhojpur	1,790	1,825	48	12
Darbhanga	943	1,385	71	53
Dhanbad	1,365	828	224	84
East Champaran	1,287	1,889	28	22
Gaya	2,344	1,684	218	147
Giridih	2,860	1,194	512	95
Gopalganj	1,398	1,078	73	38
Hazaribagh	3,276	1,438	330	72
Katihar	1,239	1,057	75	24
Madhubani	1,028	1,489	36	31
Monghyr	2,636	2,389	391	103
Muzaffarpur	1,726	1,783	64	39
Nalanda	1,011	1,185	21	13
Nawada	1,488	1,191	42	12
Palamau	3,218	1,434	334	60
Patna	1,311	1,571	16	21
Purnea	10,025	2,635	109	24
Ranchi	3,836	2,255	369	133
Rohtas	3,017	1,791	154	31
Saharsa	2,493	2,244	61	59
Samastipur	1,213	1,768	76	46
Santal Parganas	1,302	3,003	2,447	381
Saran	1,591	1,611	99	69
Singhbhum	4,351	1,798	1,356	387
Sitamarhi	993	1,533	32	40
Siwan	1,436	1,410	50	47
Vaishali	1,391	1,271	104	60
West Champaran	1,357	1,469	47	31
Total	67,566	50,361	7,904	2,331

irrigation. Even this utilisation figure includes irrigation from minor sources such as flow irrigation schemes, etc. which cannot provide effective irrigation during periods of drought. If we exclude these sources, only about 13 per cent of the net sown area has assured irrigation. The major and medium irrigation projects in the State are shown in Table 4.

Canals and wells are the most important sources of irrigation. They together account for more than one-third of the net irrigated area. As reported in *The Times of India* of October 26, 1975, a Rs 45-crore programme to sink about 45,000 tubewells was launched in 1973 in 11 districts in north Bihar. The World Bank is giving Rs 24 crores for this project as credit. Minor flow irrigation schemes are also proposed to be taken up in the plateau region. In the light of the Bihar State Irrigation Commission's Report, the Government is preparing a long-term plan of diversion weirs to

divert the water of perennial rivers to water-starved south Bihar through a network of canals. While a project for diversion of the Bagmati river has been prepared, a similar scheme for diversion of the Mahananda river has also been undertaken.

Drinking water: As per official data collected by our Patna correspondent, out of the 67,566 villages in the State, 13,714 villages covering only 5 per cent of the total rural population do not have adequate drinking water facilities. The district-wise data regarding villages without adequate drinking water facilities are presented in Table 5.

According to the Planning Department of the Government (*Approach to the Fifth Five-Year Plan*, September 1972, pp. 22-23), up to the end of September 1972, out of the 201 towns 82 towns were provided with piped water supply, thus covering 68 per cent of the total urban population. The Gov-

ernment proposes to provide water supply to all the remaining towns by the end of the Fifth Plan.

Water balance: As for the long term thinking of the State Government on development of water resources, Patna correspondent reports that Bihar has total utilisable 'water balance' of 526 lakh acre feet to irrigate 260 lakh acres. The surface and sub-soil water now being exploited, can irrigate only 238 lakh acres. But nearly half of it is lost in transit and only the remaining portion reaches the fields. To reduce this heavy wastage the Government is thinking of long-term planning to line the canals systematically, as has been done in Punjab. By the year 2000, the deficit of water would be much more acute because of a steep rise in requirements for agriculture, industry and human consumption. It has been estimated that by 2000 A.D., the requirement of water would be of the order of 472 lakh acre feet against the total available water balance of 727 lakh acre feet.

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GUJARAT

Inadequate water resources

MORE than in most other States of India, inadequate water resources pose a major problem for the people and economy of Gujarat. If we leave out the southern districts of Bharuch, Surat, Valsad and Dangs, the average annual rainfall is generally less than 75 cm (29 inches), unevenly distributed and extremely erratic. Except for the Narmada and the Tapi, there is no other perennial river whose water could be harnessed to mitigate the instability in agriculture. Floods and scarcities are frequent. The gradual disappearance of forests from large areas has hastened the process of desiccation and the erosion of soil over large parts of the State, particularly along the banks of the rivers. As could be expected under conditions of desiccation, soils are generally poor.

Rainfall: The average annual rainfall in Gujarat is rather insufficient (81 cm or 32 inches). Again, over as much as 61 per cent of the area of the State, the rainfall is highly unreliable and over 16 per cent of the area, it is totally unreliable (Table 1).

Southern Gujarat, on the whole, receives a reasonably good rainfall (100 cm to 200 cm or 39 to 78 inches). That is, only one-third of its cultivated area can be said to have an assured rainfall. In the remaining parts, the rainfall is less than 100 cm (39 inches), and it goes on decreasing as one moves northward. In Deesa in the north, the average rainfall is as low as six cm (2 inches). Again, in Kutch, North Gujarat and Saurashtra, the rainfall is not only meagre, but it also varies largely from year to year. As a result, in this region there are, on an average, three droughts every ten years and three other years are agriculturally poor.

Drought-prone areas: According to the Irrigation Commission (1972), there are 60 drought-prone talukas/mahals in 11 districts of the State (Table 2). These areas account for about one-third of the total area (1.96 lakh sq km) of the State and a quarter of its population.

Rivers: All the rivers in the State, except the Narmada and the Tapi, are seasonal. Even in the case of these two rivers, the flows are subject to wide variations. For instance, the flow of the Narmada fluctuates from the high flood discharge of 56,600 cusecs during

the monsoon to about 28 cusecs or less in the summer. All these rivers carry more than 90 per cent of their annual flows during the monsoon months. The other rivers are small, because the rainfall in these basins is very low. If the water of the Narmada is used on the basis of the recommendations of the Khosla Committee, it would irrigate 19 lakh hectares in the State, besides providing 211 mw of power. It may be noted that the bulk of the 19 lakh hectares of land that would be irrigated by the projects, lies in areas that may properly be described as normally drought-prone areas. This, in turn, may help reclaim some saline land of the Rann of Kutch.

Floods: Though Gujarat has large arid or semi-arid areas, it is often devastated by floods. The flood discharges of the Tapi and the Narmada are comparable with those of the other great rivers of the country. On the other hand, the rivers of the northern parts are subject to flash floods. The absence of an adequate natural drainage system is widespread in the northern parts of the State, generally in the flat districts of Banaskantha, Mahesana and Ahmedabad and the low land area connecting the Saurashtra peninsula to mainland Gujarat. This leads to flash floods.

The total length of inland navigable waterways in the State is 286 km. The Narmada, the Tapi, the Mahi, the Mindholo, the Ambika and the Purna offer some scope for navigation near their confluence with the sea and for a considerable distance upstream. There are no canal waterways. The regions on

the banks of the Narmada and the Tapi are rich in mineral wealth, agriculture and forest products. It is, therefore, considered necessary to undertake the development of inland water transport on the basis of the recommendations of the Bhagwati Committee.

Table 2 : Districts and talukas identified as drought-affected

District	Talukas/mahals
1. Ahmadabad	Dhandhuka, Dholka, Sanand, Viramgam.
2. Amreli	Amreli, Babra, Jafrabad, Khambha, Lathi, Liliya, Rajula.
3. Banaskantha	Dhanera, Radhanpur, Santalpur, Tharad, Vav
4. Bhavnagar	Bhavnagar, Botad, Gadhada, Gariadhar, Kundla, Vallabhipur.
5. Bharuch	Hansot, Jambusar, Vagra.
6. Jamnagar	Jodiya, Kalavad, Kalyanpur, Okhamandal.
7. Kheda	Cambay, Matar, Mehmedabad.
8. Kutch	Abdasz, Anjar, Bhachau, Bhuj, Khadir, Khavda, Lakhpatt, Mandvi, Mundra, Nakhatrana, Rapar.
9. Mahesana	Chanasma, Harij, Kadi, Kalol, Patan, Sami.
10. Rajkot	Maliya, Morvi, Wankaner.
11. Surendranagar	Dasada, Dhrangadhra, Halvad, Lakhtar, Limbdi, Muli, Sayla, Wadhwan.

SOURCE : Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Volume I, Appendix 8.1, pp. 420-421.

Irrigation: Only about one-eighth of the net sown area of the State is irrigated as against one-fifth in the country as a whole. According to the Irrigation Commission (1972), Gujarat has an ultimate irrigation potential, based on surface as well as groundwater, of 38 lakh hectares, i.e., the equivalent of 40 per cent of the net sown area in 1970-71. However, of this,

Table 1 : Reliability of rainfall in Gujarat

Rainfall regions according to the degree of reliability (coefficient of variation)	Districts comprising the region	Percentage of area in the region
1. Exceptionally low reliability region (above 60 per cent)	Kutch, parts of Jamnagar and Junagadh	16
2. Very low reliability region (40 to 60 per cent)	Banaskantha, Mahesana, Sabarkantha, parts of Jamnagar, Junagadh, Kutch, Ahmedabad, Surendranagar, Rajkot and Bhavnagar	45
3. Slightly low or low reliability region (30 to 40 per cent)	Kheda, Bharuch, Amreli, Vadodara, Panchmahals, Surat, Valsad, Dangs, parts of Ahmedabad, Surendranagar, Rajkot and Bhavnagar	38
4. Satisfactory reliability (less than 30 per cent)	Parts of Valsad	1
Total		100

SOURCE : Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Volume II, p. 82.

RIVER SYSTEM OF GUJARAT



Table 3 : Major and medium irrigation projects

Project	Location of project		(Lakh hectares)		
	River	District	Ultimate irrigation potential in Gujarat		
			Completed	Under execution	Total
Narmada	Narmada	Bharuch	—	4.0	4.0
Mahi	Mahi	Kheda	1.5	1.2	2.7
Kakrapar	Tapi	Surat	2.1	0.2	2.3
Ukai	Tapi	Surat	0.7	0.9	1.6
Banas	Banas	Banaskantha	0.4	—	0.4
Hathmati	Hathmati	Sabarkantha	0.4	—	0.4
Shetrunji	Shetrunji	Bhavnagar	0.4	—	0.4
Sabarmati	Sabarmati	Ahmadabad	—	0.4	0.4
Panam	Panam	Panchmahals	—	0.2	0.2
Medium projects:	Completed	44	—	—	1.7
	Under execution	12			

NOTE : * Data for these projects are as at the end of August 1975. For the other projects, the data relate to March-end 1973.

SOURCE : Ministry of Irrigation and Power, **Annual Reports and other documents**, New Delhi.

only 32 per cent was utilised in 1970-71. Again, whatever surface water irrigation facilities have been created are not adequately used. For example, in 1974-75, only 60 per cent of the irrigation facilities available from major and medium irrigation projects were used. This utilisation percentage was only three-fourths of the all-India average. Major and medium irrigation projects in the State are shown in Table 3.

The reasons for low irrigation are partly historical. The area comprised a large number of erstwhile princely States which could not resolve their differences over riparian rights. The States were so small that often a dam site fell in one State, and its command area in another. Most of these States did not have the technical and financial competence to undertake a major project. Moreover, the alluvial plains of Gujarat did not offer suitable sites for dams, headworks, etc. These factors explain why, before the advent of planning, there was not a single major irrigation project in the State.

Wells, it may be noted, are the mainstay of irrigation in the State. Among all the States, the proportion of the area irrigated through wells is the highest (80 per cent) in Gujarat.

It is planned to make irrigation facilities available for four lakh hectares (10 lakh acres) by the end of the Fifth Plan, during which 46 medium and 12 major projects would be undertaken. Thus, of the total of 10.5 lakh hectares (26 lakh acres), nearly 8.9 lakh hectares (22 lakh acres) are expected to be brought under irrigation by the end of the Fifth Plan.

As for minor irrigation projects, work thereon is reported to have suffered a setback because of paucity of funds. The Government has set up Water Resources Development Corporation which would raise finances for minor irrigation like tubewells and

Table 4 : Villages without any source of drinking water

District	Total number of villages (1971)	Without drinking water source	
		Villages	Hamlets
Ahmadabad ..	681	232	55
Amreli ..	595	178	—
Banaskantha ..	1,359	273	11
Bharuch ..	1,137	275	—
Bhavnagar ..	879	181	—
Dangs ..	311	104	—
Gandhinagar ..	75	7	3
Jamnagar ..	706	278	—
Junagadh ..	1,092	295	—
Kheda ..	952	70	165
Kutch ..	967	354	64
Mahesana ..	1,092	339	56
Panchmahals ..	1,903	157	36
Rajkot ..	860	279	—
Sabarkantha ..	1,387	196	51
Surat ..	1,218	137	6
Surendranagar ..	653	224	—
Vadodara ..	1,677	160	33
Valsad ..	826	47	57
Total ..	18,697	3,786	537

check dams. It is planned to sink 135 tubewells at a cost of Rs 144 lakhs during 1975-76 and to construct 200 check dams at a cost of Rs 64 lakhs. Stress is also laid on the need for constructing check dams and irrigation tanks where major irrigation schemes are not possible.

Drinking water: There are many small villages which depend on only

surface wells for their water supply. The quality of the supply from surface wells is also questionable and deteriorates further during the rainy season. Out of 18,700 villages and hamlets in the State, there are about 3,800 villages and 500 hamlets where even such wells do not exist and the people have to walk a long distance to get water. Official data regarding the district wise number of such villages, as made available to our Ahmadabad correspondent are presented in Table 4.

Even the large municipal corporations like Ahmadabad, Surat, Vadodara and Rajkot supply partially treated water to the urban population. The supplies in these four big cities are intermittent, and there is a widespread apprehension that the distribution pipes are contaminated. Three of these cities depend on surface water supplies only partially and the remaining quantity is from tubewells. The quality of the tubewell supplies is not uniform (Table 5).

Recently in his keynote address at the inauguration of the Ahmadabad Branch of the Indian Water Works Association, Prof R. S. Mehta, Chairman, Gujarat Water Pollution Control Board, Gandhinagar, sounded a note of warning that underground resources had to be judiciously exploited from areas where sub-surface waters of reasonably good quality and quantity were available. The quality of this tubewell water is usually reliable bacteriologically, but its salinity is usually high. Excessive withdrawal of tubewell water from areas where there is not enough groundwater replenishment tends to lower the water table. As the water table is lowered, pumps have to be changed often, and pumping becomes more costly.

In Ahmadabad city, the level of the water table is reported to be falling every year by 8.5 feet, and that only means that we are over-exploiting the groundwater resources of the area. As the scientific studies of underground water movements have not been properly carried out, many surprises, mostly unpleasant, are met with. At present there is no co-ordinating authority to regulate the sinking of private tubewells with the result that there is unplanned and competitive boring of wells. In certain areas serious damage has already been done. "The annual withdrawal from groundwater according to some estimates has been of the order of 6.9 million thousand cubic metres (TCM) in 1972 as against an annual recharge of 48 million TCM, causing thereby a net depletion of ground-

Table 5 : Drinking water facilities in Gujarat : 1971

Category	Water supply			Remarks	
	Total	Provided	Not provided		
Rural centres					
Gram panchayats	75	44	31	Quality not always uniformly reliable.	
Small rural communities ..	18,637	14,850	3,787	Quality control has to be organised.	
Special categories	9	9	—	Fairly good.	
Urban centres					
Municipal corporations ..	4	4	—	Intermittent—Restricted supplies, inadequate pressures.	
Municipalities	52	48	4	Quality generally satisfactory at production point.	
Nagar panchayats	54	36	18	Quality not always uniformly reliable.	

SOURCE : Prof R. S. Mehta, "Keynote Speech" at the inauguration of the Ahmadabad Branch of the Indian Water Works Association, July 25, 1975.

water at the rate of 2 million TCM every year." (Nambiar, R. G., "Resources of Gujarat: Water, an Analysis in Long-term Perspective").

Pollution: Industrial effluents and night soil are in large measure dumped into the rivers—in which, during eight months of the year there is insufficient water. So, the rivers get polluted. The worst case is that of the Vishwamutri near Vadodara, which receives effluents from many chemical plants. As a result, the river is polluted to such an extent that the local people in sheer disgust

have started calling it the Vishwamutri (the urinal of the universe) and in a somewhat less acute form the problem has also started developing in the Sabarmati, which receives effluents from the textile and chemical units of Ahmadabad.

It is heartening to note that the State Government is aware of the problem. Recently, on November 28, 1975 a foundation stone was laid of the Baroda Municipal Corporation's Rs 70-lakh mechanical compost plant at Atladra—a suburb of Vadodara. The plant, the

first of its kind in the country, would serve two purposes, one of manufacturing manure and the other of providing for disposal of wastes to eliminate health hazards caused by rapid industrialisation. A similar plant is being run by the Gujarat Agro-Industrial Corporation at Ahmadabad. Also, on December 13, 1975, the *bhoomi puja* ceremony of the Rs one-crore water treatment plant of Indian Petrochemical Corporation Ltd. (IPCL) was performed at Vadodara. The capacity of the plant is 24,000 cubic metres or a little less than 50 million gallons per day. The treated water will ultimately be pumped into the State Government's 56-km effluent channel which will start from the IPCL complex.

Other sources: Gujarat has ready access to limitless sea water. Its potential use lies in two directions: the direct use of sea water for farming on sandy soils and the desalination of sea water based on a cheap potential source of power like nuclear power. Both these ideas have already passed from the realm of speculation into that of reality elsewhere in the world. In this connection, specific mention may be made of a detailed report on the nuclear water desalination plant in the Kutch-Saurashtra region (and an agro-industrial complex based thereon) prepared in 1970 by the Bhabha Atomic Research Centre.

Water balance: While presenting the balance sheet of water resources of Gujarat for 1968-69, Mr R. G. Nambiar pointed out, in the paper "Resources of Gujarat: Water, an analysis in Long-term Perspective" presented at the *Seventh Gujarat Economic Conference* held recently at Valsad, that the total water utilisation was 9.53 million thousand cubic metres (TCM) as against the total supply of 9.29 million TCM, thus, leaving a net deficit of 0.24 million TCM. He also cautioned that this deficit was estimated to increase to 1.25 million TCM by the turn of the century, even after assuring that all the utilisable quantum of surface water (excluding the Narmada) would be tapped through check dams and canals. This means that not only will Gujarat have exhausted the total available supplies by 2,001 but its groundwater resources, too, will, by then, stand depleted to the extent of this deficit. Though the assessment of the supply position has its limitations, the importance of reassessing the resource position and that, too, with a sub-regional breakdown is underlined. In attempting such a balance sheet the technological developments should also be taken into consideration.

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HARYANA

Massive lift irrigation programme

HARYANA is the second most irrigated State, next to Punjab. More than four-fifths of the net sown area of the State is irrigated, which is double the all-India average. The State has only one perennial river—the Yamuna—is a major source of irrigation, and tubewell irrigation is dominant in the north-east region of the State. Still, the arid zone in the south-west, which covers about one-fifth of the total geographical area and population of the State, presents a real challenge to the State Government as far as irrigation is concerned. For the development of irrigation facilities in this region, the State Government has already undertaken a massive lift irrigation programme. The new technique of sprinkler irrigation is also being initiated with success. By and large, this is one of the few States of the country where the water problem can be regarded as rather manageable.

Rainfall: The average annual rainfall in Haryana is 76 cm (30 inches), which is scanty, erratic and unevenly distributed. It varies from 39 cm (16 inches) in Hisar district to 104 cm (42 inches) in Ambala district (Table 1). The amount of rainfall increases in the direction of south-west to north-east. The heavy concentration of rainfall from July to September occasionally causes floods and adversely affects large areas. From the agricultural point of view, almost the entire net sown area of the State falls under the low rainfall zone (up to 75 cm or 30 inches).

Table 1: District-wise average annual rainfall: 1968-72

District	Annual rainfall (cm)
Ambala	104
Mahendragarh	68
Karnal	67
Gurgaon	63
Jind	59
Rohtak	57
Hisar	39

SOURCE: Government of Haryana, The Economic and Statistical Organisation, Planning Department, **Statistical Abstract, 1973-74**, June 1974.

Drought-prone areas: The Irrigation Commission (1972) has identified six drought-prone talukas/mahals in three districts of the State (Table 2). These account for 18 per cent of the total geographical area and 19 per cent of its population.

A paper presented at the Second World Congress on Water Resources

Table 2: Districts and talukas identified as drought-affected

District	Talukas/mahals
1. Gurgaon	Gurgaon, Rewari
2. Mahendragarh	Dadri, Mahendragarh, Narnaul
3. Rohtak	Jhajjar

SOURCE: Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972, Vol. I, Appendix 8-1, p. 421.**

held during December 1975 in New Delhi discussed the experiments of cloud seeding carried out by the National

Physical Laboratory and the Indian Institute of Tropical Meteorology. The experiments were carried out from July to September 1973, over an area of 3,500 sq km in the chronically drought-affected areas of the State characterised by an erratic rainfall. The experiment involved the rejection of a mixture of common salt and soapstone in the atmosphere by means of ground-based generators. As a result, the average rainfall in the operational area was estimated to be 277 mm compared to the normal 241 mm, i.e., 15 per cent above normal. In the area outside the operational zone, the average rainfall during the season was 262 mm against the normal 367 mm or 15 per cent lower than the normal.

Rivers: There is no perennial river except the Yamuna which forms the eastern boundary of the State. However, it has a share in the supplies from the Sutlej, the Beas and the Ravi rivers of Punjab. Besides, there are seasonal torrents like the Ghaggar with its tributaries—the Patialewali, the Markanda, the Saraswati—the Chautang, the Dohan and the Sahibi which are characterised by flashy flows and heavy sediment discharge.

The annual inflow of the Yumuna—the principal river—at Tajewala has varied from 13,679 million cubic metres to 6,352 million cubic metres, and the



Jui Canal lift irrigation

RIVER SYSTEM OF HARYANA



Table 3: District-wise net irrigated area: 1972-73

District	Percentage of net irrigated area to net sown area		
Kurukshetra	..	..	77
Karnal	..	..	71
Sonepat	..	..	57
Hisar	..	..	56
Jind	..	..	46
Rohtak	..	..	43
Gurgaon	..	..	35
Ambala	..	..	24
Mahendragarh	..	..	20
Bhiwani	..	..	18
Haryana	..	..	46

SOURCE : Government of Haryana, the Economic and Statistical Organisation, Planning Department, **Statistical Abstract, 1973-74**, June, 1974, p 84.

mean annual inflow for the 25 years 1921-22 to 1945-46 was 10,312 million cubic metres. The average flow of the Ghaggar and its tributaries is of the order of 2,159 million cubic metres, mainly between June and September.

Floods: Topographically, Haryana is shaped like a saucer. Hence, the flood water accumulates in the flat portion of the saucer comprising Jind, Karnal, Rohtak and parts of Hisar district. For protecting the areas against flooding, a Master Plan with an outlay of Rs 80 crores has been formulated. For this purpose, the State has been divided into two tracts: (i) the Ghaggar tract and (ii) the Yamuna tract. The Master Plan envisages the construction of 4,988 km of surface drains and 274 km of flood embankments.

Table 4: Major and medium irrigation projects: August-end 1975

Project	Location of project		(Lakh hectares)		
	River	District	Ultimate irrigation potential in Haryana		
			Completed	Under execution	Total
Bhakra Nangal	Sutlej	.. Bilaspur (Himachal Pradesh)	6.8	—	6.8
Beas	Beas	.. Mandi (Himachal Pradesh)	—	2.6	2.6
Western Yamuna canal	Yamuna	.. Ambala Karnal Rohtak	—	2.5	2.5
Gurgaon canal	Yamuna	.. Gurgaon, Mahendragarh	—	0.8	0.8
Medium projects* ..	Completed	2 } ..	..	..	0.7
	Under execution	5 }			

NOTE : *Data relate to March-end 1973.

SOURCES : Ministry of Irrigation and Power, **Annual Reports** and other documents.



Irrigation by tubewells

Waterlogging: Recurring floods cause waterlogging. A number of places in Haryana are affected by waterlogging. The Karnal district, the talukas of Hansi, and Gohana and Safidon areas of the taluka of Jind district have large waterlogged areas aggregating about two lakh hectares. To check the rise of the water table along the western Yamuna canal, tubewells are being installed. Waterlogging has also created the problems of salinity and alkalinity in the irrigated areas.

Groundwater resources: According to Dr Raghava Rao, as quoted in the *Report of the Irrigation Commission* (1972), Vol. II, p 123. "The utilisable annual groundwater recharge in Haryana is approximately 1,838 million cubic metres (1.49 million acre feet). Nearly 81 per cent of the State either has brackish groundwater, or areas where the exploitation of groundwater recharge is not possible." The data on the district-wise average depth of groundwater in 1975, compiled by our Chandigarh correspondent from official sources are presented in Table 5.

Irrigation: As per the State replies received by the Irrigation Commission (1972), the ultimate irrigation potential in the State is 24 lakh hectares or the equivalent of two-thirds of the net sown area in 1972-73 (36 lakh hectares).

Haryana is one of the most irrigated States of India as 46 per cent of the net sown area was irrigated in 1972-73, which was nearly double the all-India average. However, the availability of irrigation facilities varied from as high as 77 per cent in Kurukshetra district to 18 per cent in Bhiwani district (Table 3).

Major and medium irrigation projects in the State are given in Table 4. A large portion of the State is served by the western Yamuna and the

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Bhakra canal systems, and together they irrigate about 1.4 million hectares. The Gurgaon canal, another major work under construction, is intended to utilise the surplus waters of the Ravi, the Beas and the Yamuna. It may be noted that in 1974-75 nearly 96 per cent of the irrigation potential created through major and medium projects was utilised.

The importance may be emphasised of an agreement between the State Government and the Government of Punjab on the sharing of waters of the perennial rivers and from the Bhakra and the Beas projects. Secondly, it is necessary to gradually expand the use of groundwater from tubewells in all those areas where groundwater is not brackish, particularly in the north-eastern regions of the State. Any surplus water being used from canals for irrigation in these areas can be conserved and utilised in those drier and drought-prone areas where suitable groundwater is not available for irrigation. Thirdly, in view of the intensive and extensive exploitation of groundwater through tubewells in the north-eastern region, it is reported that the

Table 5: District-wise average depth of groundwater in Haryana: 1975

District	Metre
Ambala	2—15 (in plains) 15—46 (in hilly tracts)
Bhiwani	15—38
Gurgaon	2—15 24—41 (in arid areas)
Hisar	3—38
Jind	5—37
Karnal	2—21
Kurukshetra	2—21
Mahendragarh	12—46
Rohtak	3—15
Sirsa (a)	N.A.
Sonepat	3—8

NOTE : (a) Water resources data have not yet been compiled for this district which was created on September 1, 1975.

water table is sinking. So, it is necessary for the State Government to regulate the tubewell drilling programme undertaken by farmers.

The main sources of irrigation in the State are canals and tubewells. In 1972-73, canals and tubewells accounted for 58 per cent and 37 per cent respectively of the net irrigated area.

For the first time, "operation sprinkling," a new experiment in irrigation, has been launched in Haryana. Out of the initial target of 165 sprinkling units, each costing Rs 20,000, about 100 units have already been commissioned in the sub-montane and sandy areas of Bhiwani, Jhajjar, Mahendragarh and Narainagarh. The State Government has submitted to the Agricultural Refinance and Development Corporation a scheme for setting up another 1,600 sprinkler units involving an investment of Rs 3.38 crores.

The areas bordering Rajasthan have a reverse slope and receive scanty rainfall and the groundwater there is mostly brackish. For extending irrigation facilities to these drought-prone areas, the State Government has undertaken the following lift irrigation schemes. The particulars of these schemes as reported by our Chandigarh correspondent are briefly presented below:

- (i) *Jui lift irrigation scheme*: This was taken up in November 1969 and completed in the record time of two working seasons. The scheme envisages an extension of irrigation to 36,000 hectares of gross area and 30,000 hectares of culturable command area;
- (ii) *Indira Gandhi canal system*: It was taken up in 1970, and the work is nearing completion. The scheme envisages an extension of irrigation to 1.3 lakh hectares of gross area and 1.1 lakh hectares of culturable command area;
- (iii) *Birendra Narayan Chakravarty canal system*: The work on this scheme (Stages I to III) which started in September 1971, is nearing completion. The work on Stage IV was recently taken up. The

scheme in its four stages envisages the extension of irrigation to 97,000 hectares of gross area and 74,000 hectares of culturable command area;

- (iv) *Pandit Jawaharlal Nehru lift irrigation scheme*: This is the largest lift irrigation scheme envisaging an extension of irrigation to 2.8 lakh hectares of gross area and 2.3 lakh hectares of culturable command area. The work on the part known as the Jhajjar lift irrigation scheme has already been completed, and the main project is likely to be taken up shortly.

Our Chandigarh correspondent further reports that while catering to the larger requirements of big projects, the State Government has not lost sight of the need to develop adequately the minor irrigation programme. Haryana State Minor Irrigation (Tubewells) Corporation is actively engaged in drilling deep and shallow tubewells and in lining water courses.

According to our Chandigarh correspondent, the work of lining the channels to conserve the water lost through seepage is progressing gradually. The works of lining channels in hand are: (i) Hansi branch, (ii) Delhi branch, (iii) Delhi tail distributary and (iv) Sunder sub-branch in head reaches. With a view to cutting down the cost and saving the land, the existing canals are being lined with pre-cast cement concrete blocks in the rotational closures. For the first time, polyethylene lining has been done on an experimental basis in the head reaches of the Sunder sub-branch.

Drinking water: Our Chandigarh correspondent also reports that district-wise figures of villages and population still without adequate drinking water facilities are not available. But the total number of villages in the State without adequate drinking water facilities as on March 17, 1975 was 5,911 out of the total number of 6,670 villages. Thus, only 759 villages (including 50 *dhanies*: small villages were not counted in the census) had been provided with adequate drinking water facilities.

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HIMACHAL PRADESH

Ample water resources

LIVING in the lap of the Himalayas, Himachal Pradesh is endowed with copious rainfall and snow-fed perennial rivers. But, by and large, its mountainous terrain and peculiar mode of cultivation, viz, terrace cultivation, hinder the adequate use of irrigation facilities from major projects.

Rainfall: The average annual rainfall in the State is fairly high at 184 cm (72 inches). It varies from 283 cm (111 inches) in Kangra district to 45 cm (18 inches) in Lahul and Spiti district. The Alpine region remains under snow for about five to six months in a year.

Table 1: Average depth of groundwater in the districts of Himachal Pradesh

District	Average depth of groundwater (metres)	
	1968	1975
Chamba	27	30
Kangra	11 to 17	9 to 15
Mandi	20 to 23	17 to 22
Kulu	About 40	30 to 39
Lahul & Spiti ..	About 40	Above 40
Bilaspur	9 to 17	7 to 12
Mahasu	15 to 20	10 to 15
Simla	23 to 30	20 to 30
Sirmaur	25 to 30	20 to 25
Kinnaur	Above 40	Above 40

NOTE: Groundwater in the hilly areas is not possible to touch. The average given is of the sub-mountainous and plain areas. The figures are based on a survey conducted by the Geological Survey of India in 1968, and the present average has been derived from the earlier survey. According to this survey, groundwater in Himachal Pradesh has undergone very little change during the past four decades.

Rivers: The State is drained by a number of snow-fed perennial rivers, such as the Chenab (Chandrabhaga), the Ravi, the Beas (Vipasha), the Sutlej (Shutundri) and the Yamuna. According to the assessment of the Department of Multi-purpose Projects and Power as given in the *Report of the Irrigation Commission, 1972, Vol. II, P. 142*, the average annual flow of the principal rivers for the period 1943 to 1962 was 16,503 million cubic metres

(13.38 million acre feet). However, the natural reservoirs and the steep drops available in the river courses pro-

department have, so far, prepared only reconnaissance reports showing the depth of the water in the various regions. It is reported that there are very few areas where open percolation wells can be successfully sunk. According to the data collected by our Simla correspondent, the present total water balance of the State is about 15.85 mil-

Table 2: Villages without adequate drinking water facilities

District	Number of villages in the district	Population of all villages in the district ('000)	Villages without adequate drinking water facilities	
			Number	Population ('000)
Chamba	1,126	255	16	13
Kangra	6,150	1,327	21	13
Mandi	2,789	515	9	6
Kulu	169	192	4	3
Lahul & Spiti ..	204	24	13	5
Bilaspur	911	195	20	7
Mahasu	2,894	440	30	9
Simla	1,631	217	19	5
Sirmaur	965	245	11	3
Kinnaur	77	50	17	3
Total	16,916	3,460	160	67

vide immense potential for hydel power rather than for irrigation.

Groundwater: The Geological Survey of India and the State Geology

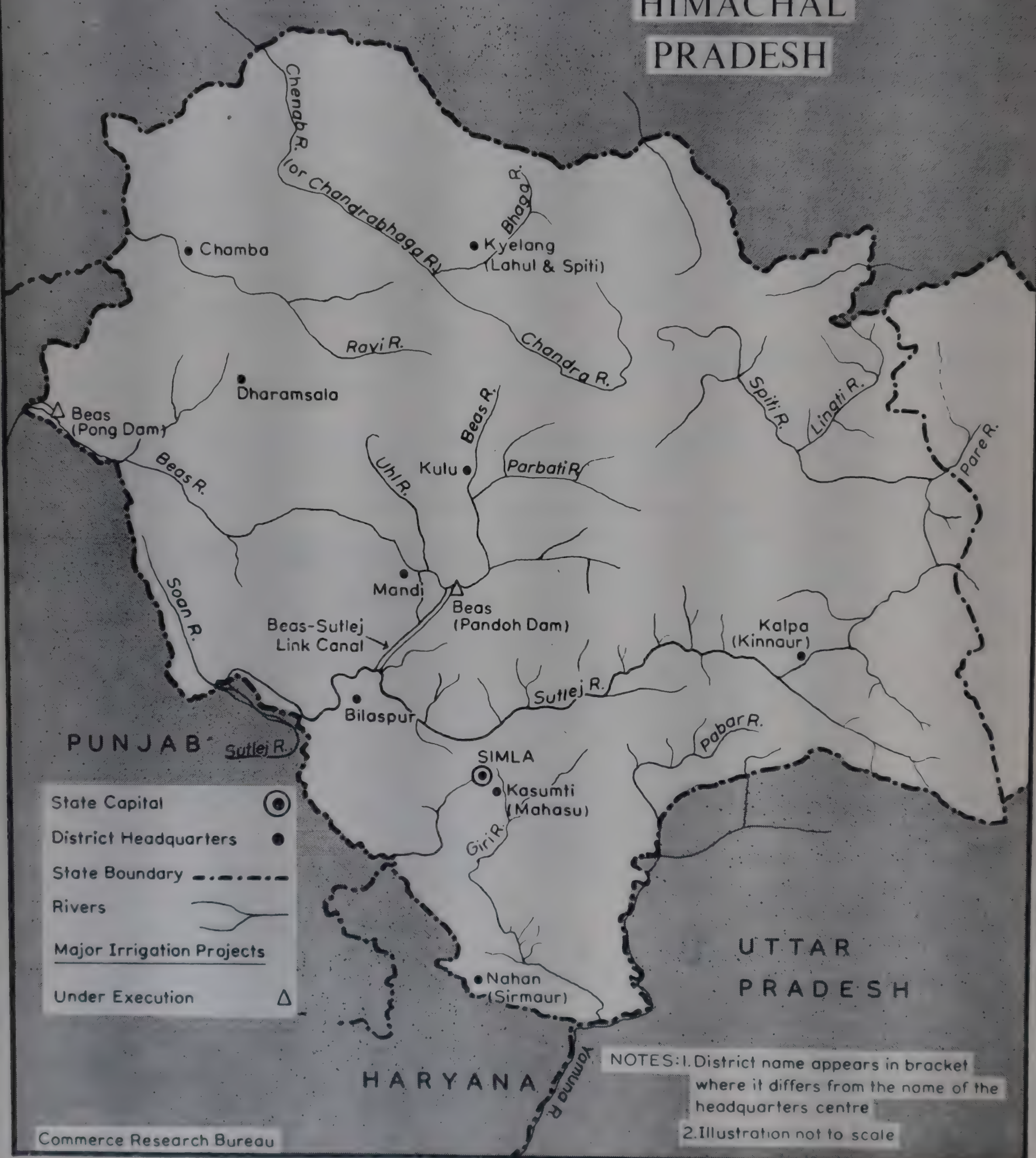
lion acre feet, besides 0.62 million cubic metres of groundwater. In view of its geographical situation and elevation, the water losses due to evapora-

A mountainous stream which provides water for human consumption and farm irrigation.



RIVER SYSTEM OF
HIMACHAL
PRADESH

JAMMU & KASHMIR



- State Capital (Double circle symbol)
- District Headquarters (Solid dot symbol)
- State Boundary (Dashed line symbol)
- Rivers (Wavy line symbol)
- Major Irrigation Projects (Under Execution) (Triangle symbol)

NOTES: 1. District name appears in bracket where it differs from the name of the headquarters centre
2. Illustration not to scale

on and percolation are said to be insignificant. The average depth of groundwater in the submountainous and plain areas varies from 7 metres to 40 metres (Table 1). The Department of Agriculture has begun sinking wells in the valleys, and an area of 800 hectares has been brought under irrigation. There are also possibilities for sinking tubewells in the Paonta valley of Sirmaur district.

Irrigation: In 1970-71, 17 per cent of the net sown area was irrigated. Cultivation in the State is generally done on terraced fields on hill slopes and in the valleys. Hence, usually farmers construct small contour channels which are fed from local springs or hill streams. These channels, though usually temporary and damaged by floods and landslides during the rainy season, are the principal source of irrigation. There are three important canals—Chandrapur, Bata Majra and Rampur Giri—which together command the cultivable area of about 2,100 hectares. Besides, experts attached to the Indo-German Agricultural Project have been experimenting with lift irrigation and sprinkler irrigation. For lift irrigation electric pumps are used, and for sprinkler irrigation as in Mandi and Sirmaur districts, mobile sprinkler sets. There is a proposal to implement the first medium irrigation scheme at an estimated cost of Rs 1.4 crores, which will be linked up with the Giri-Bata Hydel Project in Paonta valley of Sirmaur district. When completed, the project will irrigate about 5,200 hectares of land in the Paonta valley.

Drinking water: Our Simla correspondent has reported that over five million cusecs of water is being utilised for human consumption. In higher reaches of the State, where winter drags on for over eight months in a year, human water consumption is much less than in the sub-mountainous and lower areas, owing to intense cold and regular usage of woollens. In those higher reaches, water sources get snow-bound and inaccessible during winter, and the people, therefore, utilise snow as a substitute for their daily consumption of water. As can be seen from Table 2 only 10 per cent of the villages with just two per cent of the population in the State do not seem to have adequate drinking water supply.

"The main sources of drinking water are the deep flowing nullahs and local springs, and the villagers, many a time, have to fetch water from long distances. They sometimes collect rain water in small ponds which is evident-

The Giri-Bata irrigation canal which, when completed, will irrigate long tracts of unirrigated land in Sirmaur district



ly most unhygienic. For solving this problem, water supply schemes have been taken up by the Government. By the end of 1974-75, it was expected that

2,937 villages with a population of 8.10 lakhs would be covered by water supply schemes," (*Economic Review of Himachal Pradesh*, 1975, pp. 44.45).

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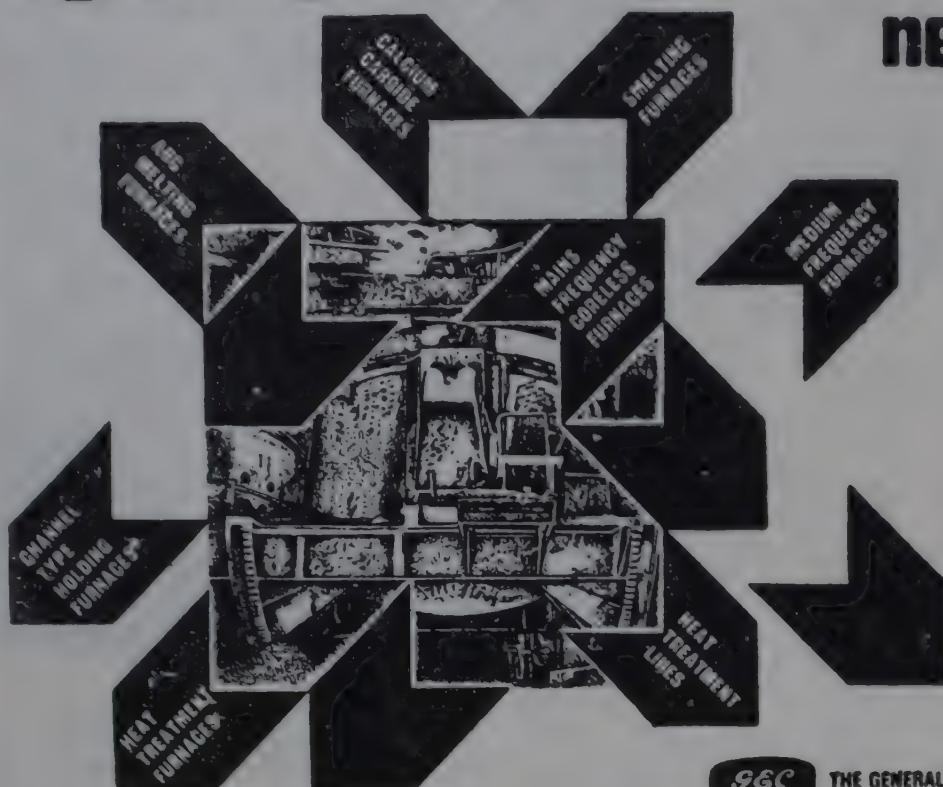
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Paddy fields in Lolab Valley where a number of storage tanks, to conserve and utilise rain water, have been constructed by the Government.

JAMMU AND KASHMIR

Land of springs, lakes and rivers

THE topography of Jammu and Kashmir is dominated by snow-clad mountains broken by stretches of forested valleys, lovely lakes and picturesque perennial rivers. On the whole, there is no water problem as such.

Rainfall: Jammu and Kashmir has an average annual rainfall of 102 cm (40 inches). About 48 per cent of the rainfall is between June and September, 24 per cent between March and May, 19 per cent during January and February and 9 per cent between October and December. Again, the rainfall is the heaviest in the south, for example 152 cm (60 inches) in Reasi in Udhampur district, and gets reduced northward. In the Kashmir Valley it varies from 76 cm to 89 cm (30 to 35 inches). The northernmost region—Ladakh—receives the lowest rainfall of 10 cm (4 inches).

Rivers: The main rivers which drain about three-fourths of the State are the Jhelum, the Indus, the Chenab and their tributaries. The rivers are snow-fed and hence perennial, but exhibit wide variations in their flows during different periods of the year (Table 1).

The north-western Ladakh has an inland drainage system, and the rivers

drain into small lakes. The distribution of the drainage pattern is indicated in Table 2.

The use of the waters of the Indus and other rivers flowing through the

Table 1 : Annual flow of rivers of Jammu and Kashmir

River	Mean annual flow (million cubic metres)		
	July to September	October to December	Total
Indus (including the Kabul river)	94,361	16,035	1,00,396
Jhelum	22,326	25,551	27,877
Chenab	24,423	4,564	28,987

SOURCE: Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 151

State is governed by the Indus Water Treaty of 1960 between India and Pakistan. Not much use is being, or can be, made of the Indus waters owing to the character of the region through which the river passes in the State, but good use is being made of the permissible amounts of water from the Jhelum and the Chenab.

Floods and waterlogging: The Jhelum river which is an alluvial stream carries considerable sand and silt, and the bed of the river has thus been silting for centuries. So, it frequently overtops the embankments and causes damage to many areas in the Kashmir Valley. Besides the Jhelum, some perennial rivers and seasonal nullahs, particularly in Punch and Rajauri districts, get swollen during the rainy season causing considerable inundation of agricultural land.

Table 2 : Drainage pattern in Jammu and Kashmir

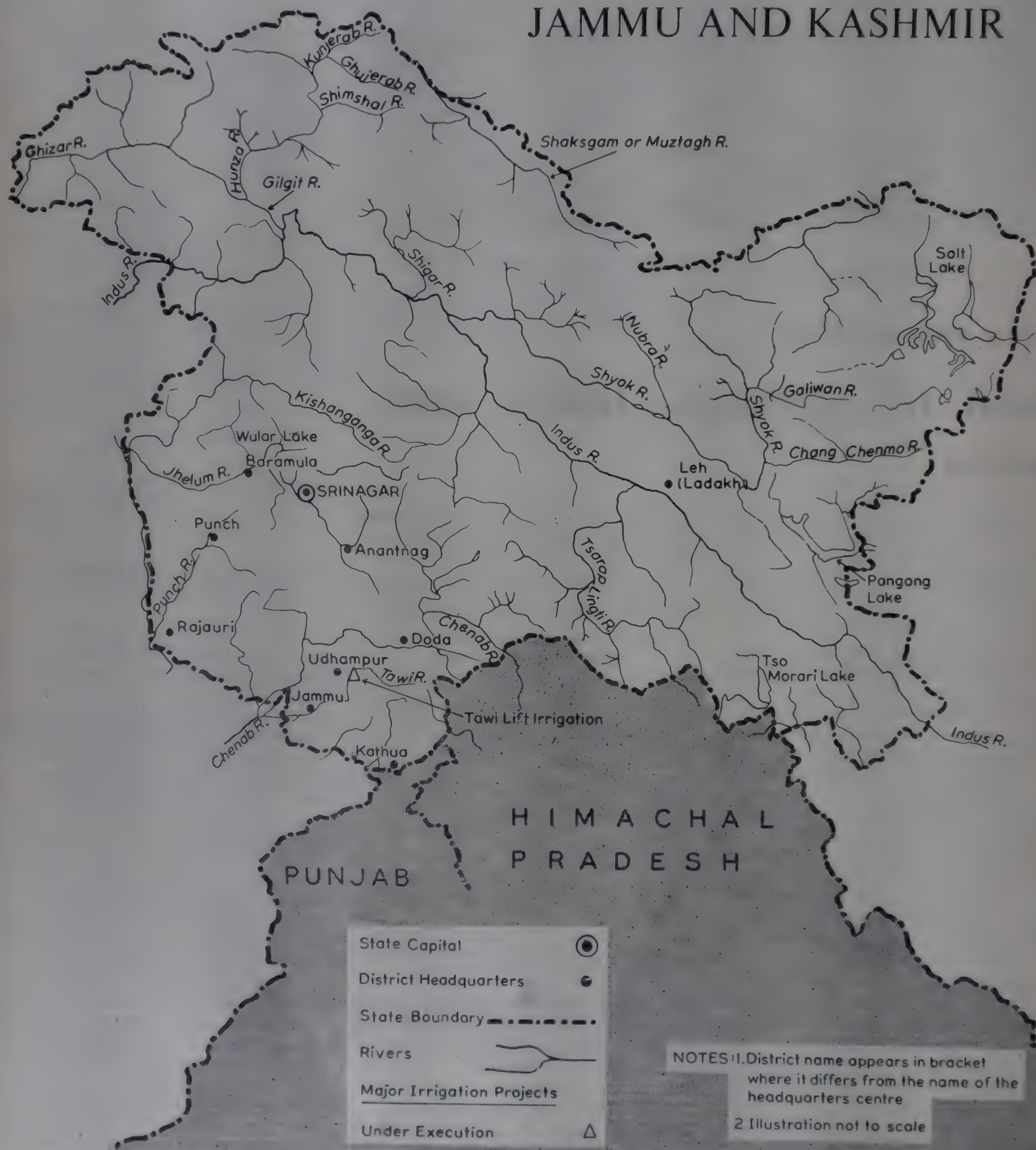
Region	Spring	Lake	River
Jammu		Mansar	Ravi
		Surimsar	Ujh
		Sanasar	Tawi
			Chenab
Kashmir	Verinag	Dal, Anchar	Jhelum
	Kokarnag	Hokarsar	Lidar, Vishav
	Achhabal	Manasbal	Rambiara
	Martand	Wular	Sukhnag
	Cheshma-shahi	Kaunsarnag	Dudganga
	Behama	Gangabal	Sind
	Tulmulla	Tarsar	Ferozepur
	Nilanag	Marsar	Nala
	etc.	Sheshnag	
		Anantnag etc.	
		Pangong	Sind
		Tso Moriri	Shyok, Zaskar Yarkand
Ladakh			

SOURCE : Raina, A. N, Geography of Jammu and Kashmir, National Book Trust, India, New Delhi, 1971

The Valley is also covered by a large number of swamps and waterlogged areas. Attempts had been made from ancient times to reclaim these areas by constructing levees and embankments. However, while the level of low-lying areas remained unaltered, the levels of the surrounding rivers and lakes have steadily risen, which has intensified the problem of waterlogging. The problem is reported to have been tackled rather effectively by installing batteries of dewatering pumps-cum-irrigation stations. This led to the reclamation of a sizable area and an addition to the existing irrigation facilities.

Drought: Though the Irrigation Commission (1972) did not identify any district or area as drought-prone, some areas do experience scarcity conditions due to low snowfall. According to the information collected by our Srinagar correspondent, there are certain chronically dry pockets such as Rajwar where the construction of storage tanks for irrigation purposes has proved a great

RIVER SYSTEM OF JAMMU AND KASHMIR



success. Besides, these tanks play an important role in moderating the effects of floods and promoting judicious use of water. With capacities ranging from 50 acre feet to 120 acre feet of water, these tanks are essentially low-cost earthen dams, 20 feet to 50 feet high, which are filled by rain and other available water. These tanks will last about a hundred years.

Inland waterways: It is reported that the techno-economic survey, conducted under the guidance of the Central Water and Power Commission, over a stretch of 170 km between Khanabal

Table 3 : Average depth of groundwater level in Jammu and Kashmir

District	Position of water table/static water level (metres)		1969	1975
Srinagar				
Qamarwari	0.57	0.50		
Safapura	9.72	9.17		
Sumbal	2.21	2.00		
Badgam	4.00	3.91		
Chattergam	6.57	6.26		
Anantnag				
Kakapora	1.72	1.51		
Pampora	3.00	2.77		
Wuyan	1.71	1.51		
Awantipora	2.57	2.36		
Tral	6.35	6.00		
Baramula				
Mirgund	2.00	1.86		
Sopora	3.00	3.00		
Sogam	4.50	4.64		
Baramula	0.96	0.96		
Hundwara	0.54	0.60		
Ladakh	N.A.	N.A.		
Jammu				
Ramgarh	3.72	4.12		
Ranbisinghpura	—	3.25		
Muthi	—	5.06		
Gajansu	—	3.10		
Ismailpur	—	23.47		
Kathua				
Kathua	—	1.44		
Hiranagar	—	1.63		
Kothian	—	2.03		
Mai-Chak	—	25.25		
Udhampur				
Reasi	25.73	—		
Punch	N.A.	N.A.		
Rajauri	N.A.	N.A.		
Doda	N.A.	N.A.		

Notes : Work in respect of groundwater exploitation has started only recently in Jammu and Kashmir.

Figures in respect of the districts of Jammu, Kathua and Udhampur indicate the minimum static water level, mainly of dug wells.

Table 4 : Villages without adequate drinking water facilities : 1973-74

District	Total number of villages	Population of all villages in the district (Lakhs)	Villages without adequate drinking water facilities	
			Number	Population (Lakhs)
Srinagar	744	4.16	633	3.06
Anantnag	1,230	8.32	1,070	6.01
Baramula	1,065	7.76	940	5.85
Ladakh	N.A.	N.A.	N.A.	N.A.
Jammu	1,128	5.42	965	4.62
Kathua	585	2.49	461	1.93
Punch	175	1.57	165	1.47
Rajauri	381	2.09	363	1.90
Doda	651	3.22	600	2.93
Udhampur	624	3.10	522	2.61
Total	6,583	38.13	5,719	30.38

in Anantnag district and Baramula, has revealed good prospects of inland water transport through the river Jhelum.

Groundwater resources: The nature, extent and thickness of the alluvial sediments afford favourable conditions for the development of groundwater. Numerous natural springs occur as a result of the effluent seepage of groundwater on the fringes of the alluvial tract towards the encircling mountain range. These springs have too insufficient a discharge to be reckoned as potential sources of water for local needs. Near-surface groundwater, particularly in the Jhelum alluvium, occurs within three metres from the surface. In the vicinity of Srinagar successful tubewells within a depth of 150 metres have been constructed, which yield about 91,000 litres of potable water per hour (*Report of the Irrigation Commission, 1972, Vol. II, p. 159*).

A systematic quantitative assessment of the groundwater resources is yet to be made. However, according to rough estimates quoted in the *Report of the Irrigation Commission, 1972, Vol. I*, 60 per cent of the total groundwater resources of 10 million acre feet (MAF) is annually lost due to evapotranspiration and sub-surface run-off, while the remaining 4 MAF of water is available for recharge. The district-wise details of the water level in 1969 and 1975 as collected by our Srinagar correspondent are given in Table 3.

Irrigation: In 1970-71, about 40 per cent of the net sown area in Jammu and Kashmir was irrigated. A notable

feature of the irrigation system in the Valley is the high proportion of irrigation by zamindari kuhls—canals—which take off from rivers, nullahs and springs. Kuhls have long been a major source of irrigation. Even in 1970-71, these canals constituted the principal source of irrigation—98 per cent (22 per cent government canals and 76 per cent private canals) which is the highest canal irrigation in the country. Up to the end of 1974-75, completed major and medium irrigation projects created a total potential for 47,000 hectares, of which 89 per cent was utilised.

Owing to difficult terrain, the scope for implementing a major irrigation project is limited. More stress, is therefore, laid on medium and minor irrigation projects. To provide assured irrigation facilities a programme of constructing new canals and installing tubewells has been launched in recent years. The Dudhar canal with an irrigation potential of 1,200 hectares in Udhampur district has been completed. Also, the 25-km-long Khubothang canal constructed at a cost of Rs 21 lakhs was inaugurated in Ladakh district on July 2, 1975. This canal, one of the highest situated canals in the world, would irrigate about 300 hectares of dry and sandy lands, 9,000 feet to 10,000 feet above the sea level, and provide drinking water to more than 10,000 persons.

A Rs 5-crore lift irrigation canal project at Tawi has been taken up for execution as part of the integrated Ravi-Tawi irrigation complex. This

Rs 30-crore complex would provide irrigation to over 48,000 hectares of land consisting largely of the Kandi belt of Kathua and Jammu districts. Recently, the Planning Commission approved a number of medium irrigation schemes—construction of new canals as well as the renovation of the existing ones.

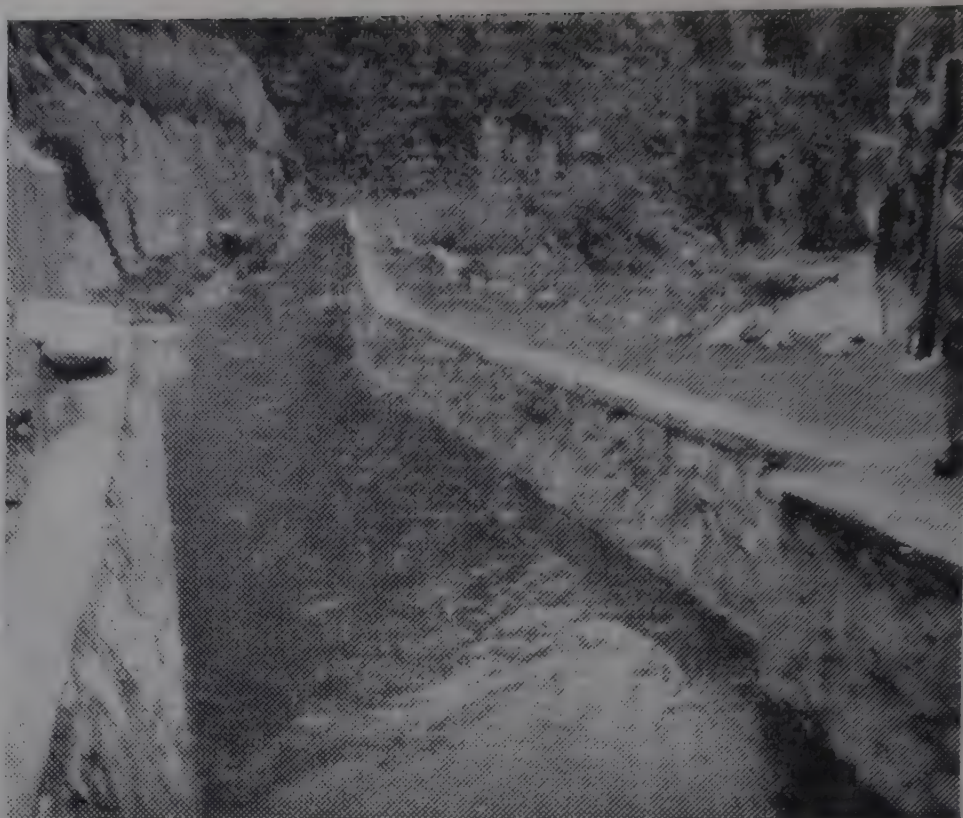
As regards utilisation of irrigation facilities, our Srinagar correspondent reports that Mr G. M. Mir, Chief Engineer of Irrigation and Flood Control in Kashmir province, has undertaken land and water studies of different basins. A preliminary study has been completed in respect of the Rambiar basin which seems to have revealed that even with its ten canals and 153 sub-canals, 43 per cent of the culturable area around the Rambiar nullah is left unirrigated. The study, therefore, recommends construction of seven dams/lift and storage schemes, besides exploring the availability of groundwater for optimum water use.

Drinking water: According to the data collected by our Srinagar correspondent, 87 per cent of the villages which cover about 80 per cent of the State's rural population were not provided with adequate drinking water

facilities as at the end of the Fourth Plan. The district-wise position is given in Table 4.

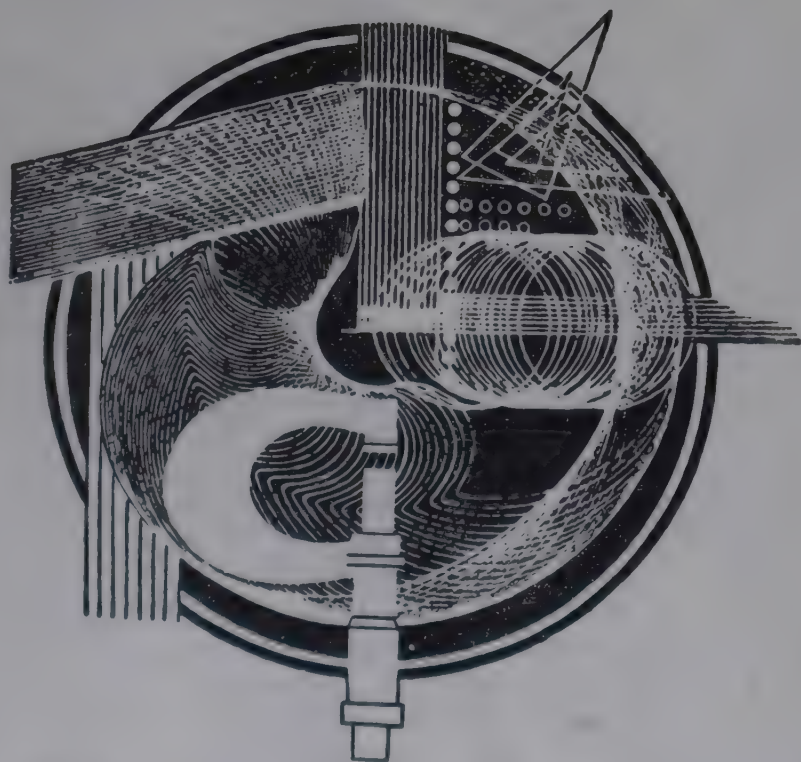
In respect of urban drinking water supply, Mr J. M. Dave has indicated in his article "Progress of Community Water Supply in India" (which appear-

ed in the *Souvenir on United Nations Seminar on Water Resources Administration*, 1973) that 40 out of 45 towns covering 93 per cent of the urban population had been provided with adequate drinking water up to the end of March 1969.



A small irrigation canal maintained by the Government

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Sprinkler irrigation is being increasingly resorted to by well-to-do farmers as a water conservation device. It is extensively used in Coffee Plantations in Karnataka.

KARNATAKA

Uneven distribution of water resources

THE Western Ghats, running parallel to the sea, divide the State into two distinct parts: the narrow coastal strip in the west and the plateau in the east. The coastal region and the mountainous range receive copious rains which, unfortunately, run off into the sea. On the other hand, the plateau region with inadequate rainfall and poor irrigation, faces frequent droughts. Recently, it has been boldly suggested that the heavy precipitation in the west should be stored and transported to the east through tunnels or other means.

Rainfall: On an average, Karnataka receives 104 cm (41 inches) of rainfall, mainly from the south-west monsoon. The precipitation in the coastal region averages 334 cm (131 inches). While some parts in the mountainous strip receive as high as 762 cm (300 inches), immediately on the east of the Western Ghats lies the rain-shadow region with an extremely scanty rainfall of 38 cm (15 inches). Then, thanks to the second wave of monsoon coming from the north-east, the precipitation again gradually increases towards the east to about 80 cm (31 inches). About two-thirds of the

net sown area falls under the low rainfall region (below 75 cm or 30 inches), one-fourth under the medium rainfall region (75 cm to 115 cm or 30 to 45 inches) and less than one-tenth under the high rainfall region (above 115 cm or 45 inches).

Drought-affected areas: The Irrigation Commission (1972) has identified 88 talukas in 12 districts of the State as drought-affected (Table 1). These talukas together account for about half the State's total area and population. No other State in the country has such a high proportion of drought-affected area.

Here, a very interesting but bold suggestion was recently made by four scientists, viz, Mr K. C. Naik, Mr K. Krishnamurthy, Mr B. V. Venkat Rao and Mr G. V. Havanagi of the University of Agricultural Sciences, Bangalore. They have suggested that the vast quantity of rain water in the Western Ghats that flows into the sea should be trapped and transported to the drought-prone areas of the east through tunnels or other means. The run-off varies between 20 to 60 per cent of the rainfall, the highest being in the mountainous

and coastal regions. About half of the mean annual run-off can be used through storage. The hilly region provides ideal locations for storing rain water by blocking valley openings. A small quantity of water may be lost by percolation, but the loss can be minimised by using plastic film. Chemicals and plastic floats can also reduce evaporation. The water may have to be carried through tunnels or through gravity or other means, across the hills to the present water courses flowing east or connecting the existing system of tanks to areas which are chronically drought-stricken. This will provide supplemental and protective irrigation as well as help in maintaining underground water at an adequate level.

Pleading for a bold departure from the traditional thinking on the conservation of water resources, the scientists have drawn attention to a parallel example. In the Imperial Valley of South California (United States) deserts have been made to bloom through the storage, lifting and transport of water over distances of more than 800 km. In

Table 1 : Districts and Talukas identified as drought-affected

District	Talukas
Bangalore	Anekal, Channapatna, Devanahalli, Doddaballapur, Hoskote, Kanakapura, Magadi, Nelamangala, Ramanagaram.
Bellary	Bellary, Hadagalli, Harapanahalli, Hospet, Kudligi, Mallapuram, Sandur, Siruguppa.
Bijapur	Badami, Bagalkot, Bagevdi, Bijapur, Bilgi, Hungund, Indi, Jamkhandi, Muddebihal, Mudhol, Sindgi.
Chitradurga	Challakere, Chitradurga, Davanagere, Hiriya, Holalkere, Hosdurga, Jagalur, Molakalmuru.
Dharwar	Gadag, Mundargi, Ranibennur, Ron.
Gulbarga	Aland, Afzalpur, Chincholi, Chitapur, Gulbarga, Jevargi, Sedam, Shahapur, Shorapur, Yadgir.
Hassan	Arsikere, Channarayana, Hole-narasipura.
Kolar	Bagepalli, Bangarpet, Chikballapur, Chintamani, Gouribidanur, Gudibanda, Kolar, Malur, Mulbagal, Srinivasapur.
Mandya	K.R. Pet, Malavalli, Nagamangala, Pandavapura.
Mysore	Chamarajanagar, Gundlupet, Hunsur, Kollegal, Nanjangud, Periyapatna, T. Narasipura.
Raichur	Deodurga, Lingsugur, Yelburga.
Tumkur	Chiknayakanhalli, Gubbi, Koratagere, Kunigal, Madhugiri, Pabagada, Tiptur, Turuvekere.

SOURCE : Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. I, Appendix 8.1, Pp. 422-423.

RIVER SYSTEM OF KARNATAKA



Karnataka, the distance might not be more than 160 km.

Table 2 : Rivers of Karnataka

River system	Drainage area lying in Karnataka	
	'000 sq km	Per cent
Krishna	113	59
Cauvery	36	19
Tributaries of Godavari ..	4	2
West flowing rivers : Netravati, Sharavati, Kalinadi, etc	25	13
North Pennar South Pennar (Ponnaiyar) Palar	14	7
Total	192	100

SOURCE : Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 270.

Rivers: The two major rivers of the country, the Krishna and the Cauvery form the lifeline of Karnataka in that more than three-fourths of the total drainage area of the State falls in the basins of these two rivers (Table 2). The Krishna river system, which drains the northern part, covers more than half of the area of the State. Its tributaries, namely, the Ghatprabha, the Malprabha and the Tungabhadra are also of economic significance. Some of the major tributaries of the Cauvery, which drains southern Karnataka, are



A farmer at work in Management of Water derived through irrigation pump fitted to a well

the Hemavati, the Lakshmanatirtha, the Herangi and the Kabbani.

If we leave aside the inaccessible areas of the Himalayas, Karnataka has the largest hydro power potential of all the States. The west flowing rivers are important for power generation as their course is through the undulating terrain of the Western Ghats. Important among them are the Sharavati, the Kalinadi and the Netravati. As for the problem of floods, it is not of a serious nature, although floods occasionally

develop in the coastal areas and some pockets in the interior.

The State's dispute with the neighbouring States on the sharing of waters of the Godavari had been pending before the tribunal since 1969. However on December 19, in a meeting presided over by the Union Minister for Agriculture and Irrigation, Mr Jagjivan Ram, the Chief Ministers of the States involved in the dispute reached an agreement through mutual talks relating to the sharing of as much as 2,300 TMC ft (Thousand million cubic feet) of waters out of a total of 3,000 TMC ft in the Godavari basin. Mr Jagjivan Ram explained that the remaining amount of available water poses no dispute at the moment because, for another 15 years or so, no new project was being envisaged by any of the States concerned. The agreement will be now filed before the tribunal and the Chief Ministers desire that the projects and programmes on which the accord has been reached need not be discussed.

Following are the highlights of the projects agreed to by Karnataka and Andhra Pradesh.

(A) Karnataka may go ahead with the following two projects, and the utilisation, will be as indicated against each:—(i) Karanja project 13.10 TMC ft and (ii) Chulkinala project 1.17 TMC ft.

(B) Andhra Pradesh may go ahead with the construction of a reservoir at Singur for the withdrawal of four TMC ft for supplying drinking water to Hyderabad city.

Table 3: Average depth of groundwater in the districts of Karnataka

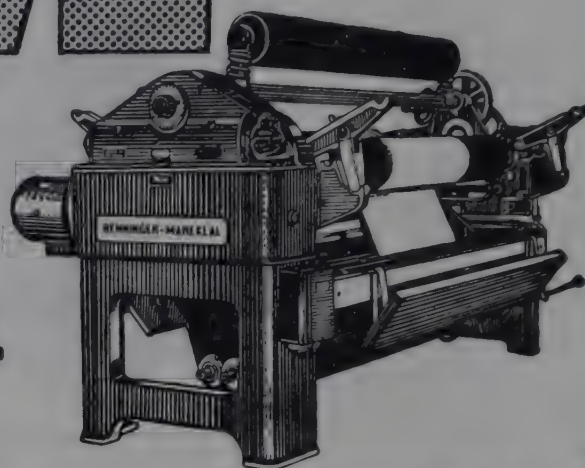
District	Average depth (Metres)							
	1972		1973		1974		1975	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Bangalore	3.00	6.40	0.30	17.76	0.60	20.15	0.40	23.00
Belgaum	1.67	7.85	1.30	13.10	0.60	17.65	0.50	18.20
Bellary	0.75	8.90	1.29	19.90	0.45	15.95	0.53	18.83
Bidar	2.28	19.74	0.98	25.60	0.70	19.20	0.50	17.25
Bijapur	1.68	11.51	0.04	28.90	0.10	28.70	0.05	23.85
Chikmagalur	1.76	17.36	0.68	17.60	1.00	17.50	0.15	17.70
Chitradurga	0.76	6.09	1.24	17.33	0.56	21.15	0.56	19.10
Coorg	0.25	14.90	0.50	14.23	—	—	0.72	18.32
Dharwar	1.10	7.00	0.80	22.20	0.50	24.90	0.60	25.55
Gulbarga	1.46	11.96	0.13	20.65	0.15	19.45	0.10	19.87
Hassan	0.64	12.03	1.40	13.57	0.55	23.30	1.00	28.57
Kolar	0.66	5.64	0.48	19.80	0.30	18.45	0.10	18.01
Mandya	—	—	1.10	11.15	0.92	18.90	1.25	19.10
Mysore	2.20	6.63	1.02	18.15	1.05	23.80	1.48	26.50
North Kanara	0.73	12.45	0.58	15.80	0.70	16.10	0.70	18.71
Raichur	—	—	0.80	22.28	0.15	22.43	0.08	20.19
Shimoga	1.70	12.50	0.35	15.65	0.80	19.40	0.50	19.42
South Kanara	1.29	11.87	0.52	17.21	0.24	17.24	0.30	17.00
Tumkur	—	—	0.43	15.16	0.08	16.55	0.15	16.94



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- Industrialists should associate the workers and employees with management.
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- They should meticulously observe the dues and industrial rules and regulations.
- They should regularly pay all their bills and taxes.

**THUS THEY SHOULD CONTRIBUTE TO THE IMPLEMENTATION OF THE 20-POINT
ECONOMIC PROGRAMME**

(Issued by Industries Department, M.P.)

Table 4: Major and medium irrigation projects: August-end 1975

(Lakh hectares)

Project	Location of project		Ultimate irrigation potential of Karnataka		
	River	District	Completed	Under execution	Total
Upper Krishna	Krishna	Bijapur	—	4.1	4.1
Tungabhadra	Tungabhadra	Bellary	3.3	0.2	3.5
Malprabha	Malaprabha	Belgaum	0.5	1.6	2.1
Ghatprabha	Ghataprabha	Belgaum	1.9	0.2	1.2
Bhadra	Bhadra	Chikmagalur	0.9	0.1	1.0
*Kabbani	Kabbani	Mysore	—	0.6	0.6
Medium projects:	Completed 14	}	—	—	0.6
	Under execution 10				

Note: *Data relate to March-end 1973.

SOURCES : Ministry of Irrigation and Power, Annual Reports and other documents.

Andhra Pradesh proposes to construct a reservoir at Singur with a capacity of 30 TMC ft and this may involve the submersion of some land in Karnataka State. In that event, the details regarding the project, and of the submersible land in Karnataka will be furnished to the Government of Karnataka for its consideration. Karnataka stated that any evaporation loss from the reservoir should come out of the share of Andhra Pradesh.

Inland waterways: The State has, in all, 444 km of navigable waterways comprising 284 km of river waterways and 160 km of navigable canals.

Groundwater resources: Our Bangalore correspondent reports that according to the Central Groundwater Board's estimates made in 1969, the annual recharge of groundwater in the State is 16.6 million acre feet (722 thousand million cubic feet). Making allowance for evapo-transpiration and sub-surface run-off losses up to 40 per cent, the net groundwater recharge is put at 10 million acre feet (434 thousand million cubic feet). The depth of groundwater varies from 0.15 metre to 16.94 metres in Tumkur district to 1.00 metre to 28.57 metres in Hassan district. The district-wise minimum and maximum average depth of groundwater for the period 1972-75 are presented in Table 3.

The State Government has established a groundwater resources cell and

a full-fledged water resources development organisation to carry out systematic studies in development of water resources.

Our Bangalore correspondent has reported an interesting experiment of recharging of groundwater by using surface water and the run-off etc. The groundwater cell of the Department of Mines and Geology has conducted such experiments. A few high-yielding wells were tried to find out the possibility of recharging the groundwater reservoir in hard rocks. It was observed that the high-yielding wells took a good quantity, almost equivalent to the capacity of the well. The experiment showed that such high-yielding wells could be located in a highly permeable fractured and jointed media by using the geophysical method of location, and such wells could be used for artificial recharging.

Irrigation: The ultimate irrigation potential from surface as well as groundwater has been assessed by the Irrigation Commission (1972) at 34 lakh hectares, which is equivalent to 33 per cent of the net sown area. However, for various reasons, the irrigation facilities in the State have remained rather inadequate. During 1970-71, only 11 per cent of the net sown area received irrigation, which was half the all-India average. Also, the surface water irrigation facilities created through major and medium projects are not fully utilised. In 1974-75, 74 per

cent of such facilities were used as against the all-India average of 81 per cent. Major and medium irrigation projects are shown in Table 4. Canals provide irrigation to about one-third of the irrigated area, whereas tanks and wells to the remaining two-thirds.

Drinking water: As for the supply of drinking water, according to the data collected by our Bangalore correspondent, only 162 villages in Dharwar district, 41 villages in Raichur district and 24 villages in Belgaum district do not have an adequate supply of drinking water. It means that all the remaining 25,999 villages out of the total of 26,826 have been provided with this facility (Table 5).

Table 5: Availability of drinking water in the districts of Karnataka

District	Total number of villages	Villages without adequate drinking water facilities
Bangalore	1,470	—
Belgaum	1,158	24
Bellary	589	—
Bidar	591	—
Bijapur	1,239	—
Chikmagalur	984	—
Chitradurga	1,250	—
Coorg	291	—
Dharwar	1,337	162
Gulbarga	1,304	—
Hassan	2,316	—
Kolar	2,828	—
Mandya	1,339	—
Mysore	1,593	—
North Kanara	1,295	—
Raichur	1,387	41
Shimoga	1,741	—
South Kanara	662	—
Tumkur	2,452	—
Total	26,826	227

Turning to urban water supply, according to the article, "The Progress of Community Water Supply in India" by Dave J. M., published in *Souvenir on the UN Seminar on Water Resources Administration*, January 1973, out of the 231 towns in the State, 155 towns covering 83 per cent of the State's urban population had been provided with either full or partial water supply up to the end of 1969.

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KERALA

No problem of water

STRETCHING along a narrow strip of lush land between the Arabian Sea and the Western Ghats, Kerala has ample water resources. With heavy rainfall over most parts of it and a number of rivers and streams. This most densely populated State has an almost assured water supply. Among all the States of India, it is the only one which has never known a drought. Thanks to a lucky combination of ample water resources and excellent soil, this State tops in the whole country in terms of per hectare value of agricultural output.

Rainfall: Among all the States, Kerala receives the highest rainfall, the average being 267 cm (105 inches), mainly from the south-west monsoon. The Western Ghats act as a natural barrier to the south-west monsoon winds, and so, almost all parts of the State get heavy precipitation. While the precipitation in the mountains averages 510 cm (201 inches), the east of the Palghat Pass and the southern borders receive 152 cm (60 inches). Though variations in rainfall over time do occur, complete failure of rains is almost unknown. Needless to say, the whole of the net sown area

here falls under the high rainfall region (above 115 cm or 45 inches).

Rivers: The State is criss-crossed by as many as 44 rivers and rivulets, most of them rising in the Western Ghats and flowing down into the Arabian Sea or into the backwaters along the coast. It may be noted that proximity to the sea of the Western Ghats which are the source of rivers naturally shortens the length of the rivers. But these rivers provide ample scope for hydro-power generation. These rivers have an average length of 60 km, and only four of them exceed 160 km in length. The most important among the west-flowing rivers is the 229-km long Periyar. Others are the Bharatapuzha, the Chaliyar (Beypore), the Pamba, the Kallada, the Muvattupuzha, the Meenachil, the Achenkoil, the Kadalundi and the Chalakudy. Besides, there are three east-flowing rivers viz, the Kabbani, the Pambar and the Bhavani which flow into the Cauvery basin, of which the Kabbani is important.

All the rivers are rain-fed and hence their flow diminishes considerably during summer. The Irrigation Commission (1972) has estimated the average annual run-off from all the rivers at 69,575 m cu m, of which the east-flowing rivers account for only 5,550 m cu m. The average annual run-offs and the area drained by the major rivers are shown in Table 1.

Floods: Flash floods are frequent and often of great severity. The heavy downpour during the south-west monsoon causes streams and rivers to swell and inundate the countryside. The floods affect mostly the midlands and the coastal belt.

Groundwater resources: A systematic quantitative assessment of groundwater has not been made so far. But the State Government has prepared a scheme for such an assessment. Meanwhile, studies by the Geological Survey of India, covering an area of 1,035 sq km in Alleppey district, have indicated that shallow aquifers exist within three to five metres of ground surface. Experimental tubewells sunk up to a depth of 64 metres yielded 43,650 to 50,000 litres of water per hour. It has been stated that the survey indicated that appreciable amounts of

water could be drawn from depths ranging up to 122 metres.

As per the estimates of the Irrigation Commission (1972), of the total 11 million acre feet of water brought in by rains and possible recharge due to canal infiltration, about 50 per cent is lost by evapo-transpiration and sub-surface run off and the remaining 5.4 million acre feet is available for annual groundwater recharge. In order to maximise the benefits of available water resources, the State Planning Board proposes to establish an advanced centre for research in water management.

Inland waterways: This State is endowed with long and continuous waterways. With 1,548 km of navigable inland waterways, Kerala ranks fifth among all the States and Union Territories in the country in this respect. Backwaters, which is a unique feature of Kerala, are very important waterways. Covering an area of about 600 sq km and running parallel to the sea, the backwaters are the commercial arteries of the State. Canals of varying width link these backwaters. They provide an important means of transport as almost all the seaports are connected with river waterways through these canals and backwaters. The port traffic can be moved easily from or to the hinterland. According to Mr M. N. Govindan Nair, Transport and Electricity Minister, the government has decided to set up an Inland water Navigation Corporation with its headquarters at Cochin to carry non-perishable cargo.

The physiography of the State has created some peculiar water problems which are discussed briefly in the following paragraphs.

(a) **Salinity:** Almost all the rivers in the State join the sea through backwater creeks. During the post-monsoon months, when the flow in the rivers is minimum, the tidal wave runs into the creeks and contaminates the rivers and streams making their water unfit either for drinking or for irrigation. The salt water covers low-lying fields and is drawn up by capillary action into adjacent high lands. Where clay bunds enclose the low-lying lands, the saline intrusions occur through seepage or when bunds are breached.

(b) **Sea erosion:** About 320 km of the 576-km-long coastline is exposed to the fury of storm-lashed waves and is constantly being eroded. This is due mainly to the heavy downpour, the turbulent sea, the tidal inflow be-

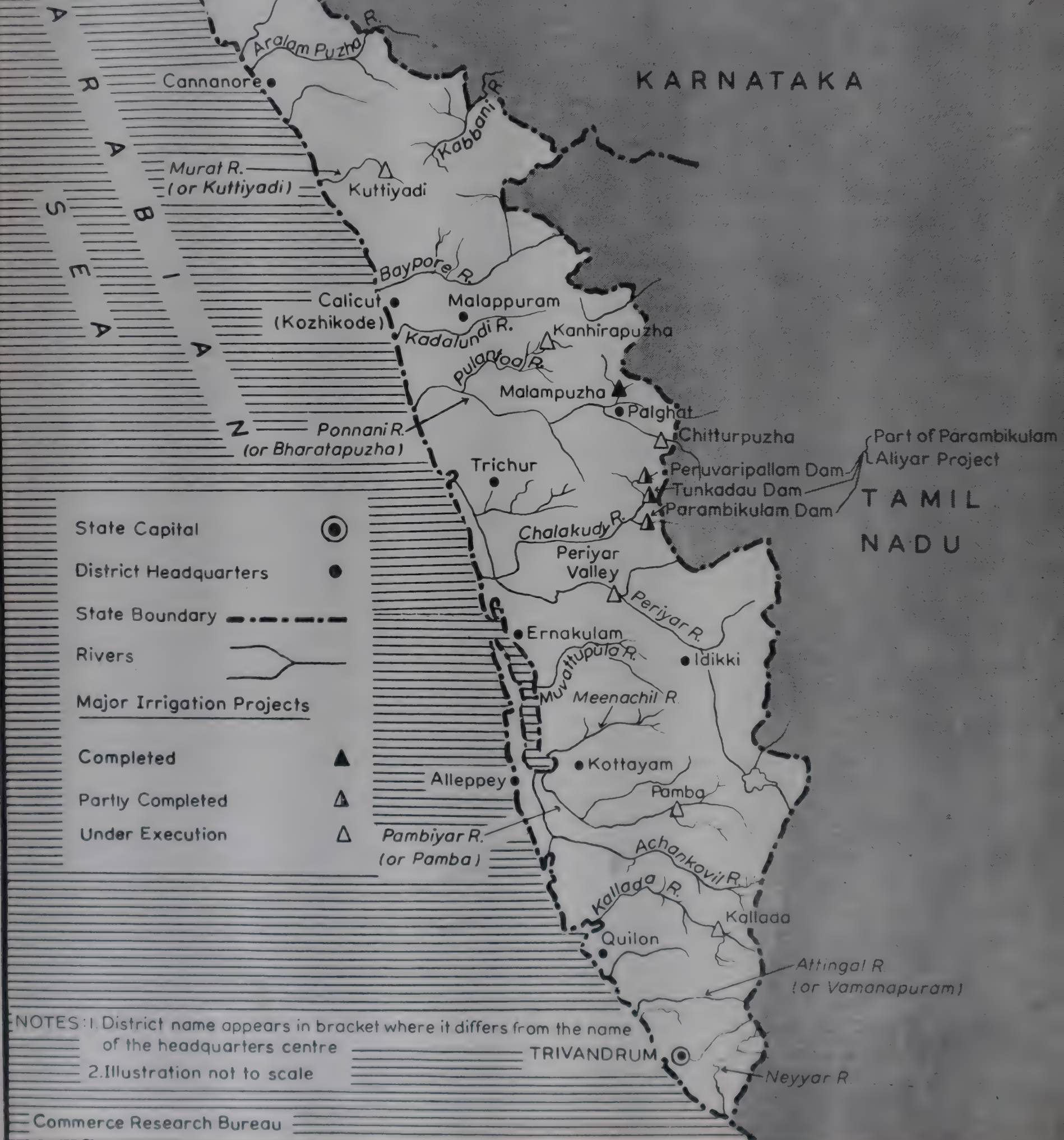
Table 1: Area drained by major rivers and their annual run-off

River	Area drained within Kerala (sq km)	Average annual run-off (m cu m)
Periyar	5,200	12,120
Bharatapuzha	3,800	6,270
Chaliyar (Beypore)	2,400	4,540
Pamba	1,950	6,310
Kabbani	1,950	4,110
Kallada	1,540	2,150
Muvattupuzha	1,500	2,650
Meenachil	1,170	2,610
Achenkoil	1,140	2,150
Kadalundi	1,100	2,190
Chalakudy	1,000	2,150
Total	22,750	47,250

Note: Major rivers include those rivers with a catchment area of 1,000 sq km or more.

SOURCE: Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 178.

RIVER SYSTEM OF KERALA



use of low level of the backshore and the unconsolidated state of the east. No exact estimates about the erosion are available. But, as per the statement laid in the Rajya Sabha, the average width of land eroded is about 10 to five metres a year. The erosion is severely threatening the rare mineral deposits in the beach sands. Besides, it is endangering the densely populated coastal region which has a concentration of export-oriented sea-food and coir industries.

Since 1955, the State Government has been taking anti-sea erosion measures. According to the studies by the Central Water and Power Research Station, Poona, sea walls and groynes are the only device to arrest the encroachment and erosion by the sea. As mentioned in *A Draft Outline, Fifth Five Year Plan, 1974-79*, brought out by the State Planning Board, till the end of 1972-73, sea walls of a total length of 97 km were constructed. While the likely achievement in 1973-74 was 20 km, the target set for the Fifth Plan is 100 km. However, the long coast of Kerala provides an inexhaustible source of aquatic wealth. The State is the largest marine fish producer in the country.

(c) *Waterlogging*: The intensive cultivation of the hill slopes result in soil erosion and the consequent silting of the drainage channels. The restricted waterway of the drainage system, in turn, causes waterlogging. Lack of proper maintenance and encroachment of drainage channels have aggravated the situation. The inadequacy of outlets into the sea is another factor contributing to waterlogging. About 10 per cent of the paddy fields in ayacut of the irrigation projects get waterlogged. These fields are to be de-watered by pumping out the water during the sowing season.

Irrigation: According to the Irrigation Commission (1972), the ultimate potential for major, medium and minor irrigation projects in Kerala is 15 lakh hectares, which is equivalent to two-thirds of its net sown area. But in 1970-71 only one-fifth of the net sown area received irrigation. However, the ample and well distributed rainfall makes it possible to raise two or even three crops a year. Hence, there is hardly any dire necessity of irrigation as such. Relatively more serious are the problems of floods, salinity and soil erosion. Major and medium irrigation projects in the State are shown in Table 2. It is heartening

Table 2 : Major and medium irrigation projects : March-end 1973

(Lakh hectares)

Project	Location of project		Ultimate irrigation potential in Kerala		
	River	District	Completed	Under execution	Total
*Kallada	Kallada	Quilon	—	1.1	1.1
Parambikulam Aliyar ..	—	Palghat/ Coimbatore (Tamil Nadu)	—	Benefit under Tamil Nadu	—
Periyar Valley	Periyar	Ernakulam	—	0.6	0.6
Pamba	Kakkad	Quilon	—	0.5	0.5
Malampuzha	Malampuzha	Palghat	0.4	—	0.4
Kuttiyadi	Kuttiyadi	Kozhikode	—	0.3	0.3
Chitturpuzha	Chitturpuzha	Palghat	—	0.3	0.3
Pazhassi	Vallapatnam	Cannanore	—	0.3	0.3
Kanhirapuzha	Kanhirapuzha	Palghat	—	0.2	0.2
Medium projects : ..	Completed : 11		1.3	—	1.3

NOTE : *Data relate to August-end 1975

SOURCES : Ministry of Irrigation and Power, *Annual Reports* and other documents

to note that whatever irrigation potential is created through major and medium projects is fully utilised, and in this respect Kerala leads all other States.

Drinking water: Mr J. M. Dave has claimed in his article, "Progress of Community Water Supply in India" (which appeared in the *Souvenir on United Nations Seminar on Water Resources Administration*, New Delhi,

January 1973), that rural population in the State received adequate drinking water as at the end of 1969.

According to the draft outline of the State's Fifth Plan, 85 out of the total 88 towns in the State were expected to have a protected water supply by the end of March 1974. In the remaining three towns the protected water supply schemes were in advanced stages of implementation.

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MADHYA PRADESH

Time to think of tomorrow

DURING the last 22 years Madhya Pradesh suffered only seven setbacks in agricultural production which, under Indian conditions, in a purely relative sense, should be regarded as a happy record. But, if in this sense water has been more or less sufficient for agricultural purposes, it is only because of two factors (1) less than the all-India average density of population (94 persons per sq km against the all-India average of 178 persons) and (2) less than the all-India average intensity of economic activity as indicated by per capita State income (Rs 458 average for the three years ended 1969-70 against the corresponding all-India average of Rs 551).

Both these factors are undergoing rapid change. First, the rate of growth of population in the State has been faster than the all-India average in recent years. Secondly, the State has been making efforts to catch up with the all-India average rate of economic activity. In the light of these two changes during the coming years, Madhya Pradesh can be expected to face a severe bottleneck in the form of shortage of water.

Obviously, better utilisation of the available resources of water would have to be the kingpin of any plan for future economic development in the State. In this context, it appears that Madhya Pradesh is concentrating too much on the Narmada resources. Of course, there is no denying that the fullest use would have to be made of the Narmada waters. But this should not mean neglect of problems of water development in other regions of the State.

Rainfall: On an average, the State receives 123 cm (48 inches) of rainfall mainly from the south-west monsoon, which varies between 141 cm (56 inches) in the east to 107 cm (42 inches) in the west. Some pockets in the eastern region also get rainfall in winter from the monsoon currents from the Bay of Bengal. Although these rains contribute only 10 to 15 per cent of the total rainfall in the State, they help in the raising of rabi crops on a wide scale. About 56 per cent of the net sown area falls under the high rainfall region (above 115 cm or 45 inches), 39 per cent under the medium rainfall region (75 cm to 115 cm or 30 to 45 inches), and the remaining 5 per cent

under the low rainfall region (below 75 cm or 30 inches).

Drought-affected areas: The Irrigation Commission (1972) has identified 24 talukas in nine districts of the State as drought-affected areas (Table 1).

Table 1 : Districts and talukas identified as drought-affected

District	Taluka
Betul	Betul, Bhalnshdehi
Datia	Datia
Dewas	Bagli, Khategaon
Dhar	Badnawar, Dhar, Kukshi, Manawar, Sardarpur, Tappa (Dharamपुर)
Jhabua	Alirajpur, Jhabua, Jobat, Petlawad, Thandla
Khandwa	Harsud, Khandwa
Khargone	Barwani, Rajpur
Shajapur	Shajapur
Ujjain	Khacharod, Tarana, Ujjain

SOURCE : Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. I, Appendix 8.1, pp. 420-421.

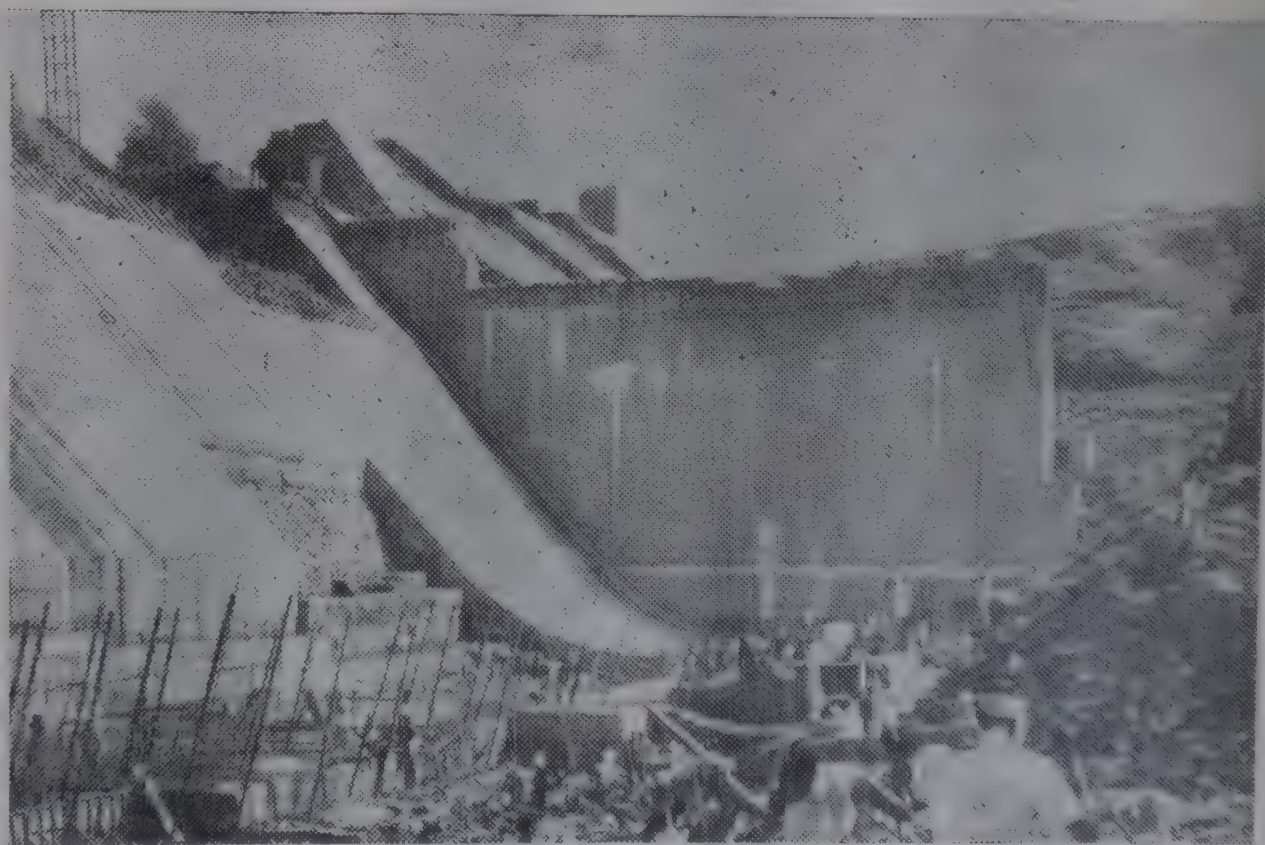
These areas lie mainly in the western parts with scanty and irregular rainfall and account for a tenth of the total area and population of the State.

Rivers: All the rivers of Madhya Pradesh are rain-fed. During the monsoon, these rivers become raging

torrents, carrying enormous quantities of water, while in the dry season they shrink to mere rivulets. The main rivers of the State are the Chambal, the Betwa, the Son, the Narmada, the Tapi, the Mahanadi and the Indravati. In the tract which lies north of the Vindhyas all streams of importance generally flow northwards to join the water system of the Gangetic Doab. The Narmada and the Tapi flow westwards to the Gulf of Cambay, while the Indravati joins the Godavari. Flowing eastwards, the Mahanadi joins the Bay of Bengal.

The State thus contributes to seven major river basins of the country, viz, the Yamuna, the Ganga, the Mahanadi, the Godavari, the Narmada, the Tapi and the Mahi. By drainage area, the Narmada is the largest river and by the average annual flow, the Mahanadi (Table 2).

The State's dispute with the neighbouring States on the sharing of waters of the Godavari has been pending before the tribunal since 1969. However, on December 19, at a meeting presided over by the Union Minister for Agriculture and Irrigation, Mr Jagjivan Ram, the Chief Ministers of the States involved in the dispute reached an agreement through mutual talks relating to the sharing of as much as 2,300 TMC ft (thousand million cubic feet) of waters out of a total of 3,000 TMC ft in the Godavari basin. Mr Jagjivan Ram explained that the remaining amount of available water



The Barna Project—the dam over the Barna river in Raisen district, near Bhopal—is now complete. The irrigation gates were opened recently. Irrigation potential is 1.5 lakh acres.

RIVER SYSTEM OF MADHYA PRADESH



NOTES: 1. District name appears in bracket where it differs from the name of the headquarters centre

2. Illustration not to scale

sed no dispute at the moment be-
use, for another 15 years or so, no
w project was being envisaged by
y of the States concerned. The
reement will be now filed before the
bunal and the Chief Ministers desire
at the projects and programmes on
hich the accord has been reached
ed not be discussed.

Following are the highlights of
e projects agreed to by Madhya
radesh and Orissa.

Table 2 : Major rivers in Madhya Pradesh

Name of river/basin	Drainage area within Madhya Pradesh (sq km)	Average annual run-off (m cu m)
Narmada	85,946	37,004
Mahanadi	77,192	39,471
Yamuna basin		
Parwati }	90,662	25,656
Sindh }		
Betwa }		
Ken	23,490	9,374
Chambal	22,600	4,441
Godavari basin		
Indravati }	65,265	34,537
Wainganga }		
Sabari }		
Pench }		
Ganga basin		
Son }	42,436	21,833
Rihand }		
Tons	14,170	6,537
Tapi	9,496	1,974
Mahi and other basins	8,229	2,467
Total		1,83,294

SOURCE : Ministry of Irrigation and Power,
Report of the Irrigation Com-
mission, 1972, Vol. II, p. 198.

I. Pending final allocation of the
Godavari water, Madhya Pradesh and
Orissa will be free to use an additional
gross quantity of 300 TMC ft and 200
TMC ft respectively, out of the water
of the Godavari basin below the
Pochampad dam site for new projects
in such manner as they deem fit.

II. In agreeing to 200 TMC ft
referred to in clause I for Orissa,
Madhya Pradesh on its part has taken
into account the estimated require-
ments within the basin only. All the
utilisation by Orissa and Madhya
Pradesh contemplated in the various
clauses shall be only as a part of the 200
TMC ft and 300 TMC ft respectively
agreed to in clause I above. The
States of Orissa and Madhya Pradesh
will not be entitled on the basis of
the subsequent clauses to utilise in any

way more than 200 TMC ft and 300
TMC ft, respectively.

III. Below the dam sites of the
upper Indravati project, as proposed
by Orissa, there is a catchment area
of about 1,855 sq miles in the Indra-
vati sub-basin up to the Orissa
boundary with Madhya Pradesh. From
this catchment there is some natural
flow across the Jasura nullah to the
Sabari (Kolab) river.

It was agreed that Orissa would
ensure at its boundary with Madhya
Pradesh a flow of 45 TMC ft in the
Indravati and its tributaries at 75 per
cent dependability for use by Madhya
Pradesh. In the years of shortage, the
shortage will be shared proportiona-
tely between the two States and the
assurance of flow in the Indravati and
its tributaries, referred to above, will
stand proportionately reduced.

Both the States agreed to joint
gauging at suitable points to ascer-
tain the yield data and to ensure the
flow of 45 TMC ft at 75 per cent de-
pendability or the proportionately
reduced flow in years of shortage that
has to flow below the common bound-
ary. The figure of 45 TMC ft is on the
assumption of total yield of 204 TMC
ft from the Indravati sub-basin in
Orissa and 91 TMC ft utilisation for
the upper Indravati project.

If the assessment of 204 TMC ft
is found to be high and the correct
figure is lower than 204 TMC ft and
the utilisation for the upper Indravati
project gets reduced from the figure
of 91 TMC ft then the figure of 45
TMC ft will get reduced in the same
proportion as the reduction in the figure
of 91 TMC ft.

IV. In view of the agreement
incorporated in the above paras, Ma-
dhya Pradesh has agreed to the clear-
ance and execution of the upper Indra-
vati project, as proposed and submitted
by Orissa to the Government of India.
Orissa has also agreed to the clearance
and execution of the Bodghat project,
as may be modified by Madhya
Pradesh taking into account the water
availability specified in clause III.

V. It has been agreed that Madhya
Pradesh and Orissa will consider the
feasibility of taking up joint projects
in the Sabari sub-basin from the point
the Sabari (Kolab) river forms the
common boundary between both the
States up to the point where it joins
the Sileru river, on the basis of common
agreements to be drawn up at the
appropriate time.

The hydel power and the cost
debitable to generation of such power

will be shared equally between the two
States in these projects. The costs and
benefits of irrigation, if any, from these
projects will also be equitably shared
by both the States. Orissa will be free
to make use of the water of this river
above the common boundary point and
lying in its territory in such manner
as it deems fit.

VI. Notwithstanding the agree-
ment on the joint projects on the river
Sabari (Kolab) mentioned in clause V,
if there is any submersion of land and
properties of either State by other
projects sponsored by the other State
or any other State in the Godavari
basin, the question of submersion and
the problems connected therewith will
have to be mutually settled before
execution of such projects.

Table 3 : Average depth of groundwater in
districts

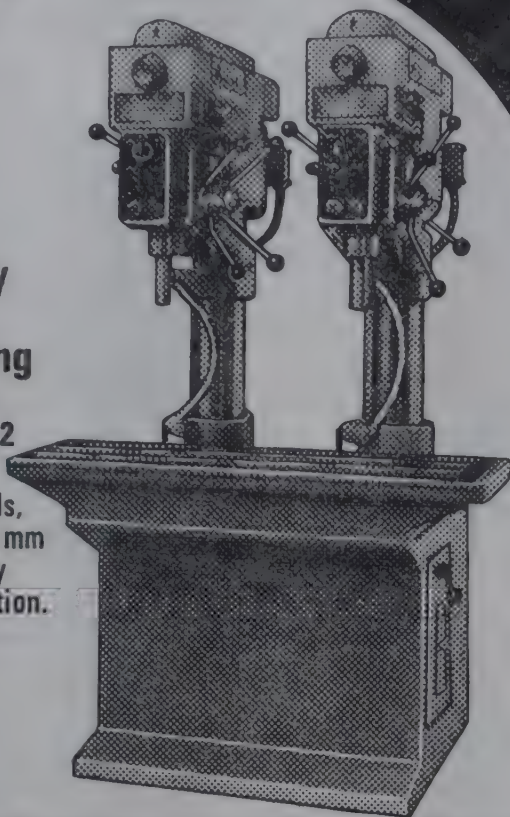
District		(Metres)	
		Average depth	
		Pre- monsoon	Post- monsoon
Balaghat	..	4.5	2.25
Bastar	..	N.A.	N.A.
Betul	..	7.5	N.A.
Bhind	..	N.A.	N.A.
Bhopal	..	6	3
Bilaspur	..	7.5	3
Chhatarpur	..	6	3
Chhindwara	..	11.5	9
Damoh	..	10	7
Datia	..	7.5	4.5
Dewas	..	7	N.A.
Dhar	..	N.A.	N.A.
Durg	..	9	4.5
Guna	..	6	4.5
Gwalior	..	6	4.5
Hoshangabad	..	N.A.	N.A.
Indore	..	10	5
Jabalpur	..	6	3
Jhabua	..	N.A.	N.A.
Khandwa	..	6	N.A.
Khargone	..	6	3.5
Mandla	..	5	3.75
Mandsaur	..	9	6
Morena	..	N.A.	N.A.
Narsimhapur	..	N.A.	N.A.
Panna	..	8	4
Raigarh	..	7.5	5
Raipur	..	9	4.5
Raisen	..	6	3
Rajgarh	..	N.A.	N.A.
Rajnandgaon	..	9	4.5
Ratlam	..	10	6
Rewa	..	N.A.	N.A.
Sagar	..	4.5	3
Satra	..	N.A.	4.5
Seoni	..	4.5	3.75
Shahdol	..	N.A.	N.A.
Shajapur	..	6	4
Shivpuri	..	6	4
Sidhi	..	15	6
Surguja	..	7.5	3
Tikamgarh	..	4	7
Ujjain	..	7.5	6
Vidisha	..	9	6

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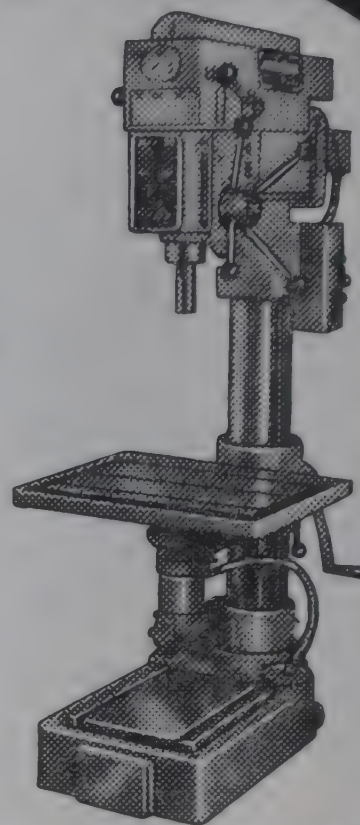
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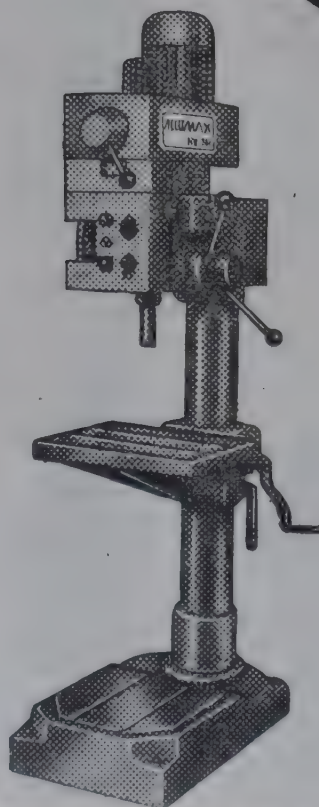
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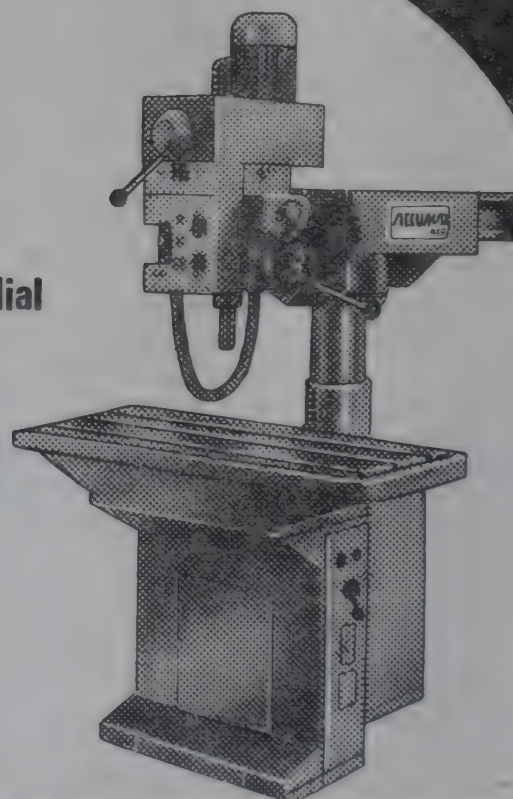
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The highlights of the projects agreed to by Madhya Pradesh and Andhra Pradesh are:

I. Madhya Pradesh and Andhra Pradesh will be free to use an additional gross quantity of 300 TMC ft each, out of the water in the Godavari river and its tributaries below the Pochampad dam site for new projects.

II. Madhya Pradesh concurs generally with the agreement arrived at between Andhra Pradesh and Maharashtra. The quantity of 300 TMC ft mentioned in clause I above will not be in addition to 300 TMC ft agreed to by Andhra Pradesh and Maharashtra.

III. In agreeing to 300 TMC ft referred to in paras I and II above, for Andhra Pradesh, Madhya Pradesh on its part has taken into account the estimated requirements within the basin only.

IV. Madhya Pradesh and Andhra Pradesh have agreed in principle to the taking up of the Inchampalli project with an FRL as commonly agreed to by the interested States—Maharashtra, Andhra Pradesh and Madhya Pradesh.

V. It has also been agreed that Madhya Pradesh and Andhra Pradesh will consider taking up the Inchampalli project as a joint project with costs and benefits equitably shared among the above three States in accordance with a common agreement.

VI. Madhya Pradesh has agreed to the taking up of the Taliperu project by Andhra Pradesh involving the use of five TMC ft water out of the 300 TMC ft agreed to in clause I and to the submersion of the river bed only in Madhya Pradesh. Andhra Pradesh agrees to put up at its cost such protective measures as would be necessary, in consultation with Madhya Pradesh, to prevent submersion of other areas in Madhya Pradesh.

Groundwater resources: As regards availability of groundwater in different parts of the State and the potential for economic development, no precise information is available. According to Mr K. C. S. Acharya's article "Administration of Water Resources in Madhya Pradesh" (which appeared in the *Souvenir on United Nations Seminar on Water Resources Administration*, January 1973), the groundwater resources of the State, based on hydrological reports gathered in the recent past, would be of the order of 49,339 million cubic metres. Even if half of this could be utilised for irrigation, and assuming a delta of 0.6 to 0.9 metres, about 2.8 million to 3.2 million hectares of land can be irrigated by ground-

Table 4 : Major and medium irrigation projects

(Lakh hectares)

Project	Location of project		Ultimate irrigation potential in Madhya Pradesh		
	River	District	Completed	Under execution	Total
*Tawa	Tawa	Hoshangabad	2.0	1.3	3.3
*Chambal	Chambal	Mandsaur	2.7	0.1	2.8
*Mahanadi Reservoir	Mahanadi	Raipur	—	1.2	1.2
Barna	Barna	Raisen	—	0.6	0.6
Matatila	Betwa	Shivpuri	0.5	—	0.5
Hasdo	Hasdo	Bilaspur	—	0.5	0.5
Medium projects	Completed	28	..	..	3.0
	Under execution	23			

NOTE : * Data for these projects are as at the end of August 1975. For other projects, the data relate to March-end 1973.

SOURCES : Ministry of Irrigation and Power, **Annual Reports** and other documents.

Table 5 : Villages without adequate drinking water facilities

(Position on June 30, 1975)

District	Total number of villages	Villages so far identified with the drinking water problem	Villages already provided with drinking water supply arrangement	Balance villages without adequate drinking water facilities
Balaghat	1,285	208	147	61
Bastar	3,500	1,347	502	842
Betul	1,276	514	285	229
Bhind	898	97	9	88
Bhopal	593	50	22	28
Bilaspur	2,529	1,719	786	933
Chhatarpur	1,076	88	46	42
Chhindwara	1,896	1,648	466	1,182
Damoh	1,144	448	253	195
Datia	416	18	11	7
Dewas	1,039	132	62	70
Dhar	1,471	446	365	81
Durg	1,629	748	419	329
Guna	1,922	262	192	70
Gwalior	760	98	61	37
Hoshangabad	1,399	73	31	42
Indore	640	106	74	32
Jabalpur	2,267	446	202	244
Jhabua	1,331	520	309	211
Khandwa	1,082	156	93	63
Khargone	1,715	510	305	205
Mandla	2,088	352	118	234
Mandsaur	1,526	72	27	45
Morena	1,290	113	61	52
Narsinhapur	993	295	157	138
Panna	934	245	146	99
Raigarh	2,181	1,087	750	337
Raipur	3,811	845	422	423
Raisen	1,401	244	69	175
Rajgarh	1,673	150	44	106
Rajnandgaon	2,412	448	372	76
Ratlam	1,038	155	98	57
Rewa	2,296	385	292	93
Sagar	1,846	252	95	157
Satna	1,753	359	154	205
Sehore	964	320	55	265
Seoni	1,585	1,087	159	928
Shahdol	1,924	872	373	499
Shajapur	1,064	87	21	66
Shivpuri	1,308	180	77	103
Sidhi	1,725	342	243	99
Surguja	2,393	947	483	464
Tikamgarh	872	32	11	21
Ujjain	1,111	215	126	89
Vidisha	1,498	183	110	73
Total	70,883	18,941	9,123	9,818

water sources. However, the irrigation potential of groundwater has been estimated by the Irrigation Commission (1972) at 1.62 million hectares, which is only half of the above estimate.

The data regarding the average depth of groundwater in the different districts during the pre-monsoon and the post-monsoon period, collected by our Bhopal correspondent from official sources, are presented in Table 3.

Irrigation: As stated earlier, the irrigation facilities in the State are extremely poor. As against the ultimate irrigation potential of 80 lakh hectares (surface and groundwater) estimated by the Irrigation Commission (1972), only 15 lakh hectares or eight per cent of the net sown area received irrigation in 1970-71 as against the all-India average of 22 per cent. In this respect, among all the States, Madhya Pradesh ranked lowest along with Maharashtra.

As for sources of irrigation, about half of the net irrigated area receives waters from canals, one-third from wells and the remaining from tanks and other sources. Major and medium irrigation projects are shown in Table 4. By the end of 1974-75, of the total surface water irrigation facilities created through major and medium

projects, more than one-fourth remained unutilised.

Worth mentioning here is the story of the Mandu lift irrigation scheme sent by our Bhopal correspondent. The scheme envisages the tapping of the Narmada waters at Khalghat only when the river is in spate, carrying the waters by stages to the Mandu cliff, which is 16 km away, lifting them 360 metres and then further transporting them 32 km right up to the Chambal watershed into three reservoirs. The scheme is yet to be surveyed. Even if the survey is taken up immediately, it will take ten years to yield results. The estimated cost is also heavy—Rs 416 crores. But it will bring irrigation water to areas with poor rainfall like Ujjain, Ratlam and Mandsaur districts. Besides ensuring drinking water of the order of 45 million gallons per day to the towns in the region, it will generate about 80 mw of power to work its lift irrigation pumps.

Drinking water: Our Bhopal correspondent reports that the drinking water supply arrangements are not satisfactory in the rural areas. Shallow dug wells are generally found to be the main source of water in the villages. Open ditches are dug in the nearby nullah bed, when these wells go dry. In some parts tanks or ponds are the

sources which are used for domestic and also for animal needs. As such, in most of the cases, available sources have been found to be contaminated. The State Government has so far identified 18,941 villages facing the water problem (Table 5). Out of these, 9,123 villages have been provided with drinking water. These 9,123 villages include 292 bigger villages where piped water supply arrangements have been made. The remaining 9,818 villages which are yet to be covered with water supply are small villages, each with an average population of 300 persons.

Turning to urban water supply according to the article, "The Progress of Community Water Supply in India" by J. M. Dave, published in *Souvenir of United Nations Seminar on Water Resources Administration*, January 1971, out of the 242 urban centres in the State, 138 centres covering about two-thirds of the total urban population were provided with drinking water facilities till the end of March 1969.

Water balance: Our Bhopal correspondent reports that water resources of the State (both surface and groundwater) are still to be systematically assessed. However, the present assessment shows that, on an average, every year nearly 150 million acre feet (MAF) of water flows down the rivers. At 70 per cent dependability, this figure may be about 110 MAF. In addition, groundwater to the extent of 20 MAF is available for exploitation in water table aquifers. These together would amount to 130 MAF and another 20 MAF is available in deep-seated aquifers. But as some water has to be let down for use by lower riparian States and the tapping of the deep-seated aquifers may perhaps be uneconomical, the utilisable flow may not be more than 103 MAF. This means that unless lower dependability flows are tapped, it may just be possible to provide low doses of irrigation water to half the cultivable area of the State.

Pollution: Ujjain, an important industrial and religious centre, faces the problem of water pollution. The main source of drinking water supply to the city is the Kshipra river which is a perennial one, but in the summer its flow is reduced considerably. The problem of pollution then assumes alarming proportions because of the disposal of industrial waste and sewage from Indore into the Kshipra through its tributary, the Khan river. Besides causing health hazards, this pollution of the holy river hurts the religious sentiments of the public.

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THE physical personality of Maharashtra is dominated by the Sahyadri mountains known as the Western Ghats. Running from the north to the south, the Sahyadri ranges provide a striking watershed dividing the coastal strip and the vast plateau which covers nearly nine-tenths of the State's area.

Until a revolution in the technology of water management brings about a radical change in the situation, the impact of the Sahyadri on the hydrology of Maharashtra could be considered most deleterious. For, as is well known, the south-west monsoon brings in enormous moisture when it enters the State. But, because of the obstruction of the Sahyadri ranges, by far the largest part of moisture is precipitated on the western side of the Sahyadri from where most of the water rushes quickly into the Arabian Sea. As a result, most of the remaining State of Maharashtra is covered by an ominous rain-shadow. What could have happened in the absence of the Sahyadri can be seen from what happens to the other branch of the south-west monsoon which enters India through the plains of West Bengal and gives a good rainfall in the interior areas right up to some districts of eastern Maharashtra.

Table 1: Districts and talukas identified as drought-affected

District	Taluka
Ahmadnagar	Ahmadnagar, Jamkhed, Karjat, Parmer, Pathardi, Sangamner, Shrigonda
Aurangabad	Gangapur, Vaijapur
Bhir	Ashti, Bhir, Georai, Patoda
Nasik	Baglan, Chandor, Kalwan, Malegaon, Nandgaon, Niphad, Sinnar, Yeola
Osmanabad	Bhum, Kallam, Osmanabad, Parenda
Poona	Dhond, Haveli, Indapur, Purandhar, Sirur
Sangli	Jath, Khanapur
Satara	Khandala, Khataw, Man
Sholapur	Akalkot, Barshi, Karmala, Mangalvedha, Mohol, Madha, North Sholapur, Pandharpur, Sangola, South Sholapur

SOURCE: Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 457

Rainfall: On an average, the State gets 106 cm (42 inches) of rainfall, which, *prima facie*, should be regarded as satisfactory. But as indicated in the preceding paragraph, there is a great disparity in rainfall on the two sides of the Sahyadri. Thus, the coastal region receives about 300 cm (118 inches) of rainfall in the south and 200 cm (79 inches) in the north. The crest zone of the Sahyadri—about 25 km wide—is the belt of the heaviest rainfall (650 cm or 255 inches). To the east of the above belt is a rain-shadow region where rainfall varies from 50 cm to 60 cm (20 to 24 inches).

Further eastwards the rainfall again shows improvement due to the westward extension of south-west monsoon currents from the Bay of Bengal. In the Bhandara and Chanda districts in the east, the annual precipitation significantly rises to about 145 cm (57 inches). About 43 per cent of the net sown area in the State falls under the medium rainfall region (75 cm to 115 cm or 30 to 45 inches), 36 per cent under the low rainfall region (below 75 cm or 30 inches) and only 21 per cent in the high rainfall region (115 cm or 45 inches and above).

Drought-prone areas: Nearly 90 per cent of the cropped area in the State is subject to the vagaries of the monsoon. The Irrigation Commission (1972) has identified 45 talukas in nine districts, mainly located in the rain-shadow belt, as chronically drought-affected (Table 1). These areas account for one-fourth of the total area of the State and 16 per cent of its population.

However, the Fact-Finding Committee for the Survey of Scarcity Areas in Maharashtra (Chairman: Mr S. E. Sukthankar) has identified, in all, 83 talukas in 12 districts as drought-prone areas which together account for 35 per cent of the total area of the State and 30 per cent of its population. They include the entire districts of Sholapur and Ahmadnagar. Besides, the State Government has also declared some parts of Nasik and Igatpuri talukas in Nasik district, Haveli taluka in Poona district and Ahmedpur taluka in Osmanabad district as drought-prone areas.

Rivers: All the rivers of the State are rain-fed, and hence their flow in off-season is limited. The drainage system of the State can be divided into two sections: one section of the rivers of the plateau and the other of the rivers in the coastal region. The three major rivers which drain the Maharashtra plateau, viz, the east flowing Krishna and the Godavari and the west flowing Tapi, are all inter-State rivers. More than half of the State's area is covered by the Godavari basin, one-fifth by the Tapi basin and the remaining, mainly by the Krishna basin. The length and the drainage area of these rivers are shown in Table 2. One of the major rivers of the country, the Narmada forms a part of the northern boundary of the State along a stretch of 54 km in Dhulia district.

Table 2: Major rivers of Maharashtra plateau

River	Length in Maharashtra (km)	Drainage area in Maharashtra (sq km)
Godavari	668	78,564
Bhima	451	46,184
Wardha	455	46,182
Wainganga	295(a)	37,998
Tapi	208	31,360
Krishna	282	24,683

NOTE: (a) Includes length and drainage area in Madhya Pradesh

SOURCE: Deshpande C. D., Geography of Maharashtra, National Book Trust, New Delhi, 1971

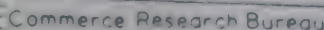
In contrast, the rivers in the Konkan region are short, varying in length from 49 km to 155 km, swift and intensely seasonal. All the same, they together account for about one-third of the total average annual flow of all the rivers of Maharashtra (Table 3). But because of the ruggedness of the terrain and the steep gradient, most of the waters cannot be utilised. The Vaitarna, the Ulhas, the Savitri and the Vashist are the more important among them.

By and large, the State is free from the menace of floods. However, sometimes flash floods do occur. For instance in September 1975, following torrential rains, the Godavari and some of its tributaries inundated several areas in Nanded and Parbhani districts.

The State's dispute with the neighbouring States on the sharing of waters of the Godavari is pending before the Tribunal since 1969. However, on Decem-

G U J A R A T

MADHYA PRADESH



NOTES: 1. District name appears in bracket where it differs from the name of the headquarters centre
2. Illustration not to scale

9, at a meeting presided over by the Union Minister for Agriculture and Irrigation, Mr Jagjivan Ram, the Chief Ministers of the States involved in the dispute reached an agreement through mutual talks relating to the sharing of as much as 2,300 TMC ft (thousand million cubic feet) of waters out of a total of 3,000 TMC ft in the Godavari basin. Mr Jagjivan Ram explained that the remaining amount of available water posed no dispute at the moment because, for another 15 years or so, no new project was being envisaged by any of the States concerned. The agreement will be now filed before the tribunal and the Chief Ministers desire that the projects and programmes on which the accord has been reached need not be discussed.

Following are the highlights of the projects agreed to by Maharashtra and Andhra Pradesh (reported in *The Times of India*, December 20, 1975):

I. Maharashtra can use all waters up to the Paithan dam site on the Godavari and up to the Siddheswar dam site on the Purna.

II. (i) From the waters in the area of the Godavari basin below the Paithan dam site on the Godavari and below the Siddheswar dam site on the Purna and below Nizamsagar dam site on the Manjra and up to the Pochampad dam site on the Godavari, Maharashtra can utilise waters not exceeding 60 TMC ft for new projects, including any additional use over and above the present sanctioned or cleared utilisation as the case may be.

Table 3: Average annual flows of rivers

	Average annual flow in m.cu.m. (a)
West-flowing streams of Konkan	42,480
Godavari basin (incl. the Pranhita and the Indravati sub-basin) ..	37,830
Krishna basin (incl. the Bhima sub-basin)	27,920
Tapi basin	7,250
Narmada basin	620
Total ..	1,16,100

NOTE : (a) Estimated on the basis of 75 per cent dependability

SOURCE: Ministry of Irrigation and Power, *Report of the Irrigation Commission, 1972, Vol. II, p. 230*

II. (ii) Andhra Pradesh can go ahead with building its Pochampad project with an FRL of 1,091 and MWL of 1,093 and is free to utilise all the

Table 4: Major and medium irrigation projects

Project	Location of project		(Lakh hectares)		
	River	District	Ultimate irrigation potential in Maharashtra		
			Completed	Under execution	Total
*Bhima	Bhima	Poona and Sholapur	—	1.7	1.7
*Jayakwadi	Godavari	Aurangabad	0.2	1.2	1.4
*Krishna	Krishna/Venna	Satara	—	1.1	1.1
*Warna	Warna	Sangli	—	1.0	1.0
Mula	Mula	Ahmednagar	—	0.7	0.7
Girna	Girna	Nasik	0.6	—	0.6
Purna	Purna	Parbhani	—	0.6	0.6
Kukadi	Kukadi	Poona	—	0.6	0.6
Upper Tapi	Tapi	Jalgaon	—	0.6	0.6
Itiadh	Garvi	Bhandara	—	0.5	0.5
Upper Godavari	Godavari	Nasik	—	0.5	0.5
Bagh	Bagh	Bhandara	—	0.3	0.3
Khadakvasla	Mutha	Poona	—	0.3	0.3
Vir	Nira	Poona	0.3	—	0.3
Ghod	Ghod	Border of Poona and Ahmednagar	0.2	—	0.2
Pus	Pus	Yeotmal	—	0.1	0.1
Tulshi	Tulshi	Kolhapur	—	0.1	0.1
Medium projects :	Completed	48 }	..	..	2.9
	Under execution	22 }			

NOTE : *Data for these projects are as at the end of August 1975. For other projects, the data relate to March-end 1973

SOURCES : Ministry of Irrigation and Power, *Annual Reports* and other documents

balance waters up to the Pochampad dam site in any manner it chooses for its beneficial use.

Maharashtra will take necessary action to acquire any land or structures that may be submerged under the Pochampad project and Andhra Pradesh agrees to bear the cost of acquisition, the cost of rehabilitation of the displaced families and the cost of construction of some bridges and roads that may become necessary. Maharashtra also agrees to the submersion of the river and stream beds.

III. (i) In the Manjra sub-basin above the Nizamsagar dam site, Maharashtra can utilise waters not exceeding 22 TMC ft for new projects, including any additional use over and above the present sanctioned or cleared utilisation as the case may be.

III. (ii) Andhra Pradesh can withdraw 4 TMC ft for drinking water supply to Hyderabad city from its proposed Singur project on the Manjra.

III (iii) Andhra Pradesh can construct the Singur project with a storage capacity of 30 TMC ft. Andhra Pradesh can also use 58 TMC ft under the Nizamsagar project.

IV. Maharashtra has concurred with the arrangements arrived at between Andhra Pradesh and Karnataka

in regard to the use proposed by Karnataka in the Manjra sub-basin upstream of the Nizamsagar dam site.

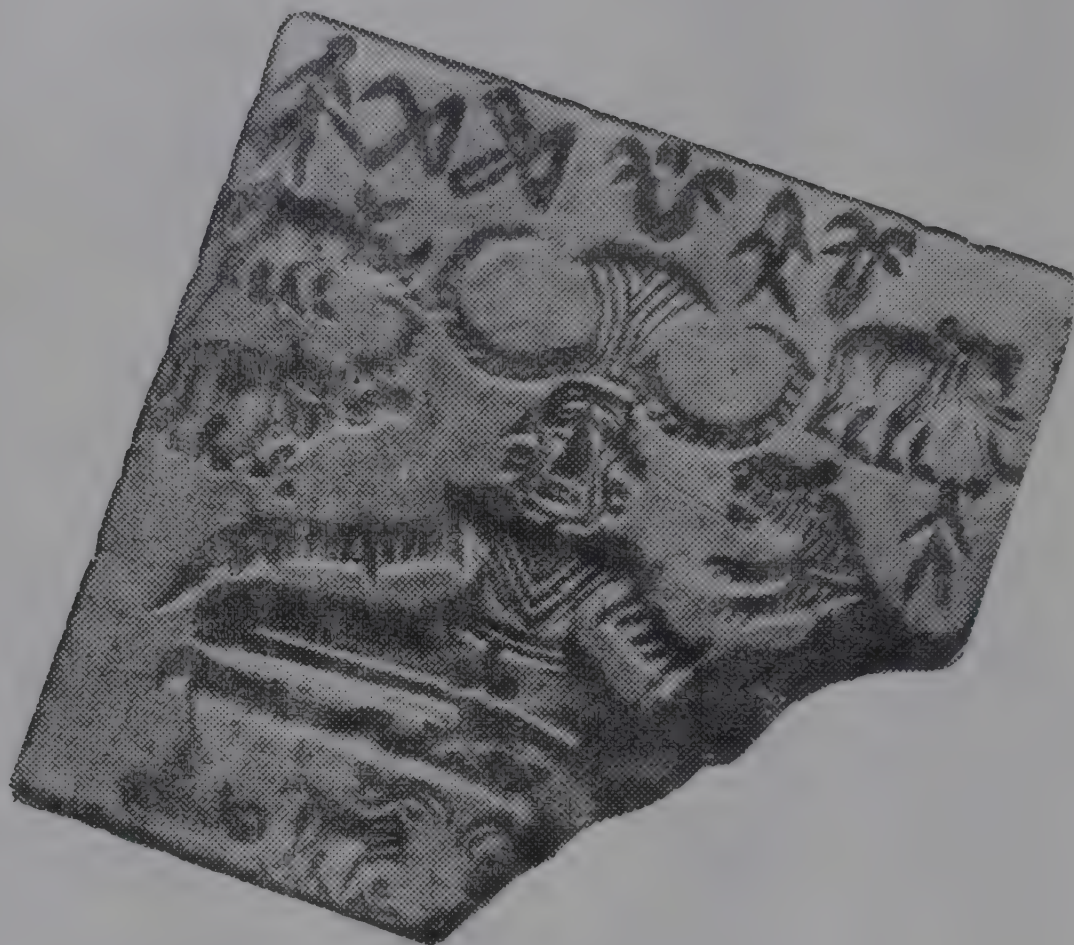
V. Maharashtra and Andhra Pradesh will be free to use an additional 300 TMC ft of water each below the Pochampad dam site for new projects.

VI. Maharashtra and Andhra Pradesh have agreed in principle to the taking up of the Inchampalli project with an FRL as commonly agreed to by the interested States, Maharashtra, Andhra Pradesh and Madhya Pradesh.

VII. Maharashtra and Andhra Pradesh have agreed to take up the following joint projects at the appropriate time with agreed utilisation: Lendi project, Lower Penganga project, and Pranhita project and to set up joint committees for this purpose.

Irrigation: Among the States, like Madhya Pradesh, Maharashtra has the lowest ratio of net irrigated area to net sown area. In 1970-71, only 8 per cent of the net sown area received irrigation as against the all-India average of 23 per cent. This is largely responsible for the extremely poor agricultural production. For example, between the trienniums ended 1961-62 and 1973-74, the annual growth rate of foodgrains production was negative at

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Throughout history Man has sought means of communication, to record his thoughts for posterity. The earliest examples of such efforts are in clay, in the form of Indus Valley Seals. Owing largely to the quality of the material used the script was stylised and pictorial. The Indus Valley script would have been different had paper existed. But paper was then beyond Man's imagination. Today, of course, Man has the advantage of a wide choice in paper, with different textures and thicknesses, for all his communication requirements

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er cent. According to the Maharashtra State Irrigation Commission, ultimate irrigation potential in State, surface as well as ground- r, is of the order of 62 lakh hec- s, of which 53 lakh hectares is a surface resources. Even after full exploitation of the available er resources, at the most, only 26 cent of the cropped area can be ight under irrigation.

The uneven plateau studded with imposes serious limitations on a e-scale development of irrigation, t does not permit a larger command a under canals and their distribu- es. On the whole, wells form the st important source of irrigation ac- ntng for about three-fifths of the irrigated area, followed by canals gating about one-fourth. Again, re is a problem of under-utilisation

Table 5: District-wise villages needing water supply: March 1974

District	Villages in need of water supply		Total
	With simple measures	With piped water	
Ahmadnagar ..	450	149	599
Akola ..	288	143	431
Amravati ..	250	146	396
Aurangabad ..	469	361	830
Bhandara ..	280	40	320
Bhir ..	400	54	454
Buldhana ..	50	143	193
Chandrapur ..	150	45	195
Dhulia ..	100	193	293
Greater Bombay ..	—	—	—
Jalgaon ..	150	497	647
Kolaba ..	300	638	938
Kolhapur ..	1,362	406	1,768
Nagpur ..	290	167	457
Nanded ..	108	320	428
Nasik ..	1,000	278	1,278
Osmanabad ..	660	400	1,060
Parbhani ..	536	50	586
Poona ..	900	144	1,044
Ratnagiri ..	1,164	298	1,462
Sangli ..	480	275	755
Satara ..	790	614	1,404
Sholapur ..	850	124	974
Thana ..	1,295	239	1,534
Wardha ..	300	21	321
Yeotmal ..	470	255	725
Total ..	13,092	6,000	19,092
As per cent of the total 35,778 villages in the State ..	36	17	53

SOURCE: Government of Maharashtra, Planning Department, Draft Outline of the Fifth Five-Year Plan (1974-79), July 1973

of irrigation facilities developed. In 1974-75, 69 per cent of the surface water irrigation facilities created

through major and medium projects were used as against 97 per cent in Tamil Nadu and West Bengal. Major and medium irrigation projects are shown in Table 4.

Drinking water: As mentioned in the Annual Plan 1975-76 of the State Government, at the end of the Fourth Plan there were 19,000 villages or more than half of the total 35,851 villages which needed attention in the matter of drinking water. Of these, 13,000 villages require simple measures such as bore wells and in the remaining 6,000 villages the problem can be tackled only by providing piped water supply (Table 5). The Government proposes to provide drinking water to all the villages by the end of the Fifth Plan.

As for urban water supply, out of the 227 towns in the State, 179 towns with a total population of 1.4 crores had piped water supply at the end of the Fourth Plan. This means more than nine-tenths of the urban population had this amenity. During the Fifth Plan, the Government proposes to provide piped water to all the remaining towns and increase the water supply to the towns where the existing supply falls short of the requirement.

Bombay, Maharashtra's largest city, gets water from rain-fed lakes like Vihar, Tulsi, Tansa and Vaitarna. Farthest among them, Vaitarna is located 118 km (74 miles) away from Bombay city. The available water supply at present is not only inadequate but also unequally distributed. The existing sources yield about 225 million gallons per day, out of which the supply for domestic purposes is estimated at about 135 million gallons per day for the population of 60 lakhs. This would mean a per capita consumption of 23 gallons per day, which is far below the Development Plan standard of 40 gallons per day.

Further, in several densely populated localities, where a majority of the people live, water is not available at all and has to be fetched illegally from municipal hydrants situated at long distances. Generally speaking, water is available for staggered hours (one or two hours) only, and special efforts have to be made at night to store water required for daily consumption.

The situation worsens when rains fail. However, efforts are afoot to bring water from the Bhatsai river

about 86 km (54 miles) away from the city. This is expected to meet Bombay's reasonable demand for water, provided the rates of growth of population and industrialisation are kept within proper limits.

Pollution: The problem of water pollution has been assuming serious magnitude, particularly in the Bombay-Poona industrial belt. The sea water around Bombay has become polluted and somewhat acidic, though the exact percentage of acidity is not known. The main cause is the discharge of effluents of industries and drainage water of Bombay, Thana and Kalyan. Further, a study conducted by the National Institute of Oceanography of Goa revealed that every year about 2,000 million cubic metres of sewage and 75 million cubic metres of industrial effluents were discharged from Bombay into the sea. In the creek the pollution has been aggravated by the spilling of oil from the ships and tankers in the port and also by the effluents of refineries and the fertiliser factory at Chembur. These have made some areas of marine waters almost septic.

Another glaring instance reported in *The Times of India* on November 24, 1975 is of the Patalganga river near Khopoli. The press report says that industrial units have so severely polluted the river that the Japanese experts managing a rice research station further downstream are no longer able to use its water for experiments with new seed varieties.

The Government has recently constituted the Maharashtra Prevention of Water Pollution Board which has classified both fresh waters and sea waters in the State according to the different uses such as domestic consumption, recreation, fishing, agriculture etc. It has also declared ten "water pollution prevention areas", viz., Ulhas, Patalganga, Kundalika, Godavari, Purna-Mula-Mutha-Bhima, Krishna, Nira, Nag, Satpati coastal area and North Bombay area. All industries, municipal councils and others in these areas producing liquid and solid will have to obtain the permission of the board for discharging wastes into the catchment of these basins.

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ORISSA

No proper conservation of water

ORISSA consists of an extensive plateau in the interior with a foreground of a wide coastal plain, sloping down gently towards the Bay of Bengal. Precipitation in the State is fairly high, and also rain-fed rivers like the Mahanadi, the Brahmani, the Baitarani pour into the Bay of Bengal. So the State, particularly its deltaic region, is visited by frequent floods. All the same, some of the areas are affected by drought. The solution to this twin problem of floods and droughts, therefore, lies in the proper conservation and utilisation of water.

Rainfall: Of an average annual rainfall of 153 cm (60 inches) in the State, about 80 per cent of the precipitation is received from the south-west monsoon from June to September, and that, too, is unevenly distributed. In the northern hilly and heavily forested plateau, covering the districts of Dhenkanal, Keonjhar, Mayurbhanj and Sundargarh, the rainfall is high, and it varies from 163 cm to 183 cm (64 to 72 inches). In the eastern hilly region, comprising the districts of Koraput, Kalahandi and parts of Ganjam, the rainfall varies from 127 cm to 152 cm (50 to 60 inches). The coastal plains consisting of Balasore, Cuttack and Puri districts and a part of Ganjam district get about 135 cm (53 inches) of rainfall.

Rivers: The river basin comprises the watershed areas of the principal rivers like the Mahanadi, the Brahmani, the Baitarani, the Burhabalang, the Rushikulya, the Subarnarekha and the Salandi which lie between the northern plateau and eastern hills. The average annual run-offs of the rivers in the State vary from 92,820 million cubic metres (m cu m) in the case of the Mahanadi and its tributaries to 111 million cubic metres (m cu m) in the case of the Salia (Table 1). Generally, more than 80 per cent of their flow occurs from June to October (Table 2).

Floods: Though these rivers are the lifelines of the State, many of them are in high spate during the rainy season, bringing ruin and devastation to the coastal and the adjacent districts. The Mahanadi, Brahmani and Baitarani rivers, when in flood, create a single

flood zone, endangering an area of about 2,450 sq km in the coastal region. According to official reports, the floods in the Brahmani and the Baitarani dur-

Table 1: Annual yields of rivers of Orissa

River	Drainage areas within the State (sq km)	Average annual run-off (m cu m)
Mahanadi and its tributaries.	57,180	92,820
Brahmani	18,750	25,286
Kolab } Godavari basin	17,752	18,983
Sileru }		
Indravati }	3,200	10,435
Subarnarekha		
Baitarani	10,240	7,228
Vamsadhara	11,377	3,663
Burhabalang	4,500	2,578
Nagavali	9,275	2,430
Rushikulya	7,956	1,764
Salandi	666	567
Bahuda	978	222
Salia	246	111

SOURCE: Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 296

ing the 1975 monsoon, damaged property and crops worth Rs 20 crores. Out of the 13 districts in the State, six dist-

riets, namely, Balasore, Cuttack, Dhenkanal, Keonjhar, Mayurbhanj and Puri were the worst hit. The Burhabalang and the Subarnarekha also caused damage to areas in their deltas measuring about 440 sq km.

The Hirakud dam has the greatest flood control potential among all the projects. Also, the Rengali multipurpose project across the Brahmani river, which is under construction, will, when fully completed, substantially control floods in an area of about 2,000 sq km in Dhenkanal and Cuttack districts. With all the completed flood control works, a total area of 5.4 lakh hectares gets protection from floods.

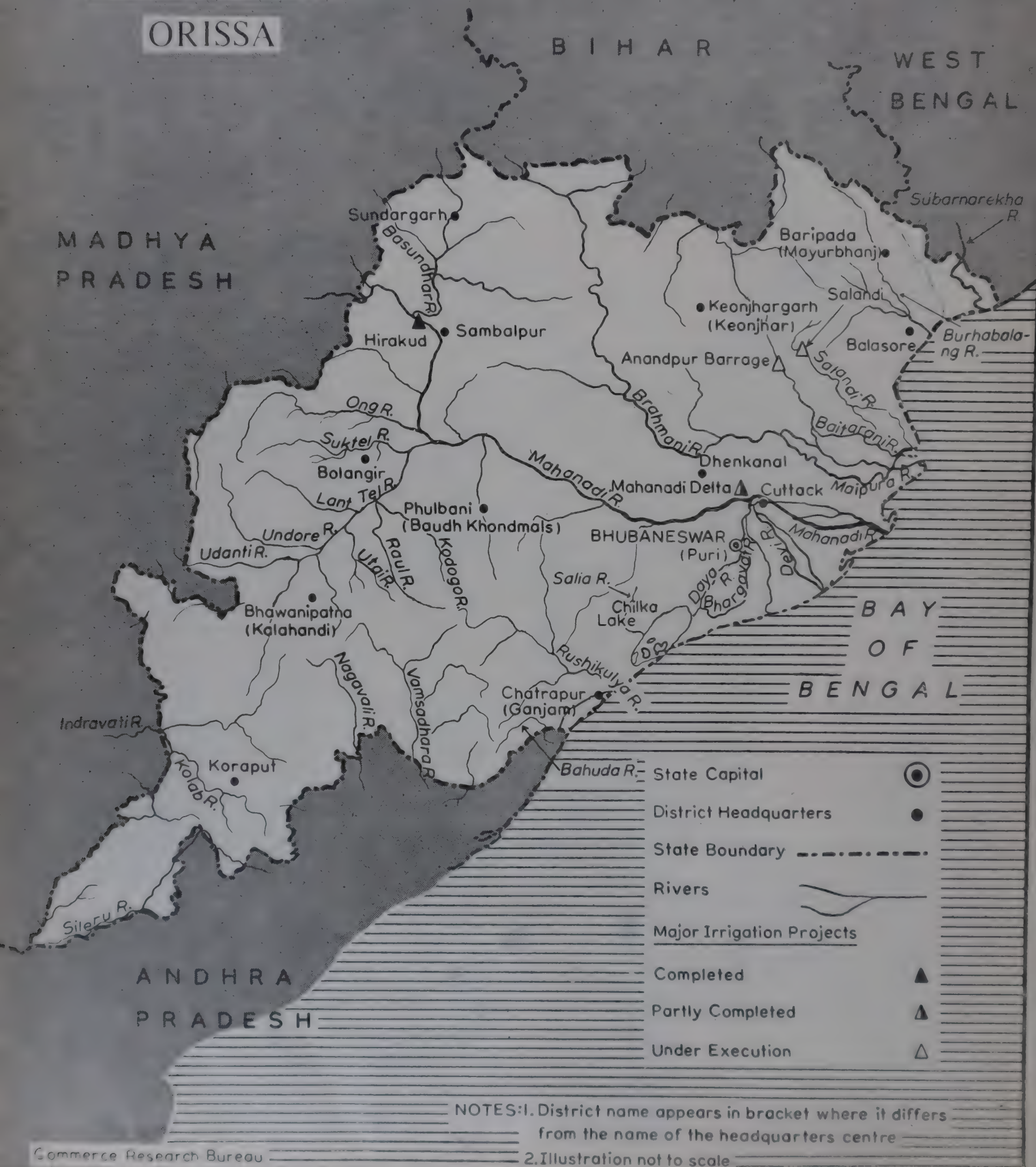
Like floods, waterlogging, too, is confined to delta areas where the river beds have gradually become higher than the adjoining land.

Drought-prone areas: After the monsoon, when there is a great need of water for raising crops, most of the rivers do not have much water and cause scarcity conditions. However, according to the Irrigation Commission (1972), there are no areas in the State which can be described as drought-prone. But the assessment of the State Government indicates that there are large areas which are exposed to drought because of the variation and uneven distribution of rainfall. Out of 314 community blocks, 67 suffer from drought conditions. These blocks are mostly confined to the erosional and coastal plains where paddy is the most important crop.



An adivasi farmer in Ganjam district manually lifting water from a dug well.

RIVER SYSTEM OF ORISSA



In the years of deficient rain, scarcity is felt in the State, but it is not confined to any particular area. In 1975, the government had declared 8 villages as scarcity-hit pockets in which a population of about 12 million

Table 2: Seasonal flows of rivers in Orissa

River	Percentage flow during the year		
	June-September	October-December	January-May
Mahanadi	82	14	4
Baitarani	83	13	4
Brahmani	82	14	4
Subarnarekha	86	12	2
Burhabalang	79	18	3
Indravati	79	17	4
Upper Kolab	66	21	13
Vamsadhara	58	38	4
Rushikulya	82	18	—

SOURCE: Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 297

as affected by drought conditions. The worst affected districts were Dhenkanal, Kalahandi, Keonjhar, Koraput, Jharkhand Khondmals and Sambalpur.

Table 3 : Major and medium irrigation projects: August-end 1975

(Lakh hectares)

Project	Location of project		Ultimate irrigation potential in Orissa		
	River	District	Completed	Under execution	Total
Major Projects:					
Mahanadi Delta	..	..	Mahanadi	Cuttack	4.6 2.2 6.8
Hirakud	..	..	Mahanadi	Sambalpur	2.5 — 2.5
Anandpur Barrage	..	..	Baitarani	Keonjhar	— 1.8 1.8
*Salandi	..	..	Salandi	Keonjhar	— 0.6 0.6
*Medium projects:					
			Completed	3 }	1.4
			Under execution	13 }	

NOTE : *Data relate to March-end 1973

SOURCE: Ministry of Irrigation and Power, Annual Reports and other documents

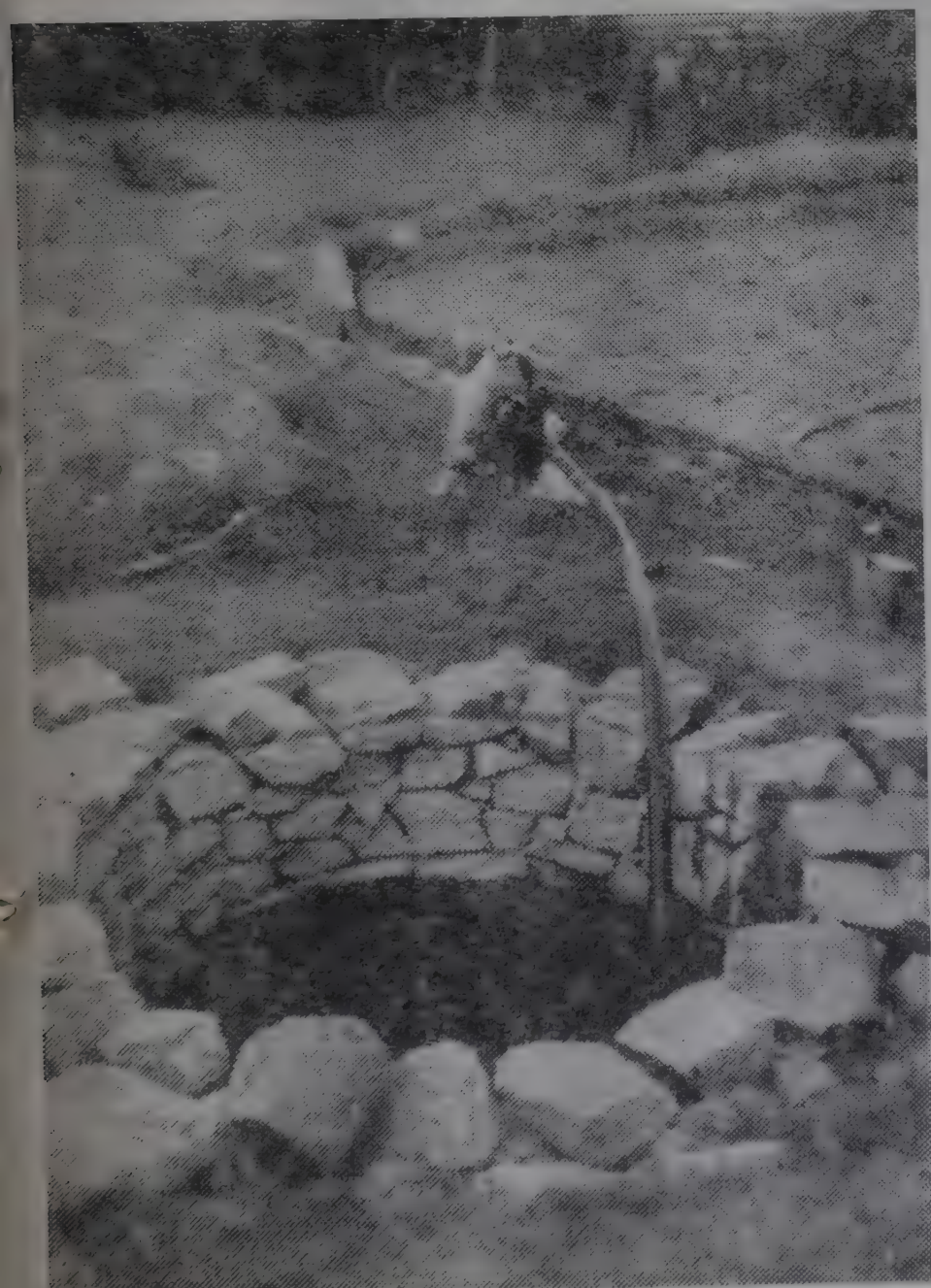
Groundwater resources: In the light of the investigations for exploration of groundwater resources carried out by the Geological Survey of India and the groundwater cell of the lift irrigation department, it is reported that in the coastal districts, which largely include coastal and river alluvia,

the total groundwater potential is estimated so far at 67 million acre feet and 16 million acre feet in the erosional and hard rock area of central and western districts. The coastal area accounting for about one-fifth of the total area of the State has nearly four-fifths of the total groundwater potential of the State.

Irrigation: Canals and tanks are by far the most important sources of irrigation. These two sources together account for nearly three-fourths of the irrigated area in the State. The canals, which are mostly of the inundation type, often dry up after the rainy season. The important inundation canals are Kendrapara canal from the river Birupa, the Taldanda canal from the Mahanadi, the Machgaon canal, etc. These canals are supplemented by water drawn through *senas* and *tandas* from the tanks, ponds and wells.

The entire net sown area falls under the high rainfall region (above 115 cm or 45 inches) which receives reasonably assured water supply. Yet, only about 19 per cent of its net sown area receives irrigation. According to the Irrigation Commission (1972), Orissa has an ultimate irrigation potential (surface as well as groundwater) of 40 lakh hectares or the equivalent of 65 per cent of the net sown area in 1970-71. Of this, only about 30 per cent was utilised in 1970-71. Major and medium irrigation projects are shown in Table 3.

With a view to improving irrigation coverage, the State Government has decided to speed up the work on incomplete projects and to take up new projects in areas where irrigation



An Adivasi using a power pump for utilising water from his dug well

density is low. The Planning Commission has also approved the Rs 12.25-crore Malkangiri project across the river Satiguda in Koraput district which is to be implemented by the Dandakaranya Development Authority. According to the master plan prepared in 1963 for utilising surface water resources for irrigation, 38 major projects, 324 medium projects and 2,578 minor irrigation projects are possible for future development of irrigation in the State. The total potential that could be created through these projects would be around 49 lakh hectares. The estimated utilisable surface water from these projects would be about 35 million acre feet.

Drinking water supply: According to the data collected by our Bhubaneswar correspondent, with 17 water basins spread over its 13 districts, Orissa has no acute problem of drinking water. All the same, due to rocky bases and salinity in the coastal areas, the need for providing drinking water through pipes, wells and tubewells is felt. Table 4 shows the district-wise number of villages which do not have adequate drinking water facilities.

As for towns, all are not provided with adequate water supply. Out of a total of 80 towns only 46 towns, covering about 85 per cent of the urban population, have either full or partial water supply.

Table 4: Availability of drinking water in villages

District	Total Number of villages	Number without adequate drinking water facilities
Balasore ..	4,376	1,142
Baudh Khondmals	4,579	1,173
Bolangir ..	2,622	1,132
Cuttack ..	6,570	2,100
Dhenkanal ..	3,093	1,251
Ganjam ..	4,590	1,586
Kalahandi ..	2,806	1,309
Keonjhar ..	2,065	507
Koraput ..	6,216	938
Mayurbhanj ..	3,954	1,231
Puri ..	4,810	1,144
Sambalpur ..	3,695	1,042
Sundargarh ..	1,548	1,339
Total	50,924	15,894

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Rainfall: The average annual rainfall in Punjab is 64 cm (26 inches) which is just half of the all-India average (119 cm). It varies between 40 cm and 80 cm (16 to 32 inches) in the plains and between 80 cm and 115 cm (32 to 45 inches) in the sub-montane districts. The district-wise average annual rainfall is presented in Table 1. Like other States, Punjab also receives the bulk of its annual rainfall from July to September. However, winter rains, though small in quantity, are crucial for rabi crops.

Table 1: District-wise average annual rainfall: 1968-72

District	Cm (inches)
Gurdaspur	100(39)
Ropar	91(36)
Hoshiarpur	78(31)
Jullundur	60(24)
Amritsar	58(23)
Ludhiana	53(21)
Patiala	53(21)
Kapurthala	48(19)
Sangrur	46(18)
Bhatinda	36(14)
Firozpur	28(11)
Faridkot	N.A.

SOURCE: Government of Punjab, Economic and Statistical Organisation, **Statistical Abstract of Punjab, 1973**, February 1974, p. 36.

Rivers: The three principal snow-fed rivers, the Sutlej, the Beas the Ravi, traverse the alluvial plains of the State in a generally south-westerly direction. They are not navigable, but the hydro power potential, particularly of the Sutlej and the Beas, is large. After the Sutlej enters the State in the Ropar district, the Beas joins it at Harike in

Firozpur district, and the combined stream flows into Pakistan. The Ravi enters Gurdaspur district and then flows into Pakistan. The maximum and minimum discharges of these rivers and their average annual run-offs at parti-

Table 2: Discharges of the major rivers of Punjab

River	Place	Cumecs
Sutlej	(i) Firozpur headworks	25,102(maximum)
	(ii) Ropar	13,867(maximum) 79(minimum)
Beas	Dera Gopipur	9,905(maximum) 60(minimum)
	Madhopur	16,980(maximum) 34(minimum)

SOURCE: Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972**, Vol. II, p. 318.

cular places are presented in Tables 2 and 3 respectively.

Irrigation: Though 85 per cent of the State's net sown area and more than 90 per cent of the net irrigated area fall under the low rainfall zone (up to 75 cm or 30 inches), Punjab occupies the pride of place in the irrigation map

of India. In 1972-73, 72 per cent of the net sown area in the State was irrigated against the average of over 20 per cent for the country. No other State has so high a percentage of the net irri-

Table 3: Average annual run-off

River	Place	Million cubic metres	Million acre feet
Sutlej	.. Bhakra	15,801	12.81
Beas	.. Mandi	15,961	12.94
Ravi	.. Madhopur	7,993	6.48

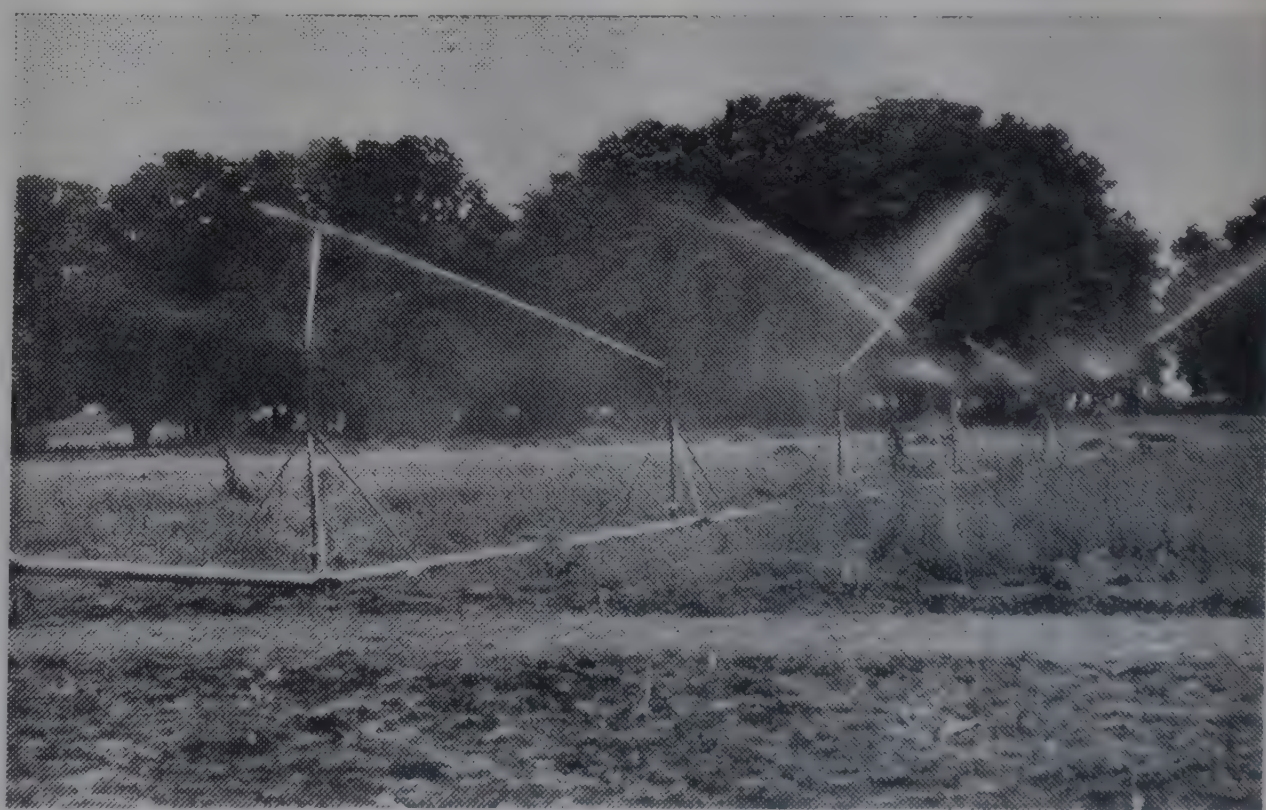
SOURCE: Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972**, Vol. II, p. 319.

Table 4: District-wise net irrigated area: 1972-73

District	Percentage of net irrigated area to net sown area
Amritsar	94
Ludhiana	84
Sangrur	82
Jullundur	81
Kapurthala	81
Faridkot	78
Firozpur	72
Patiala	70
Bhatinda	66
Gurdaspur	54
Ropar	35
Hoshiarpur	29
Punjab	72

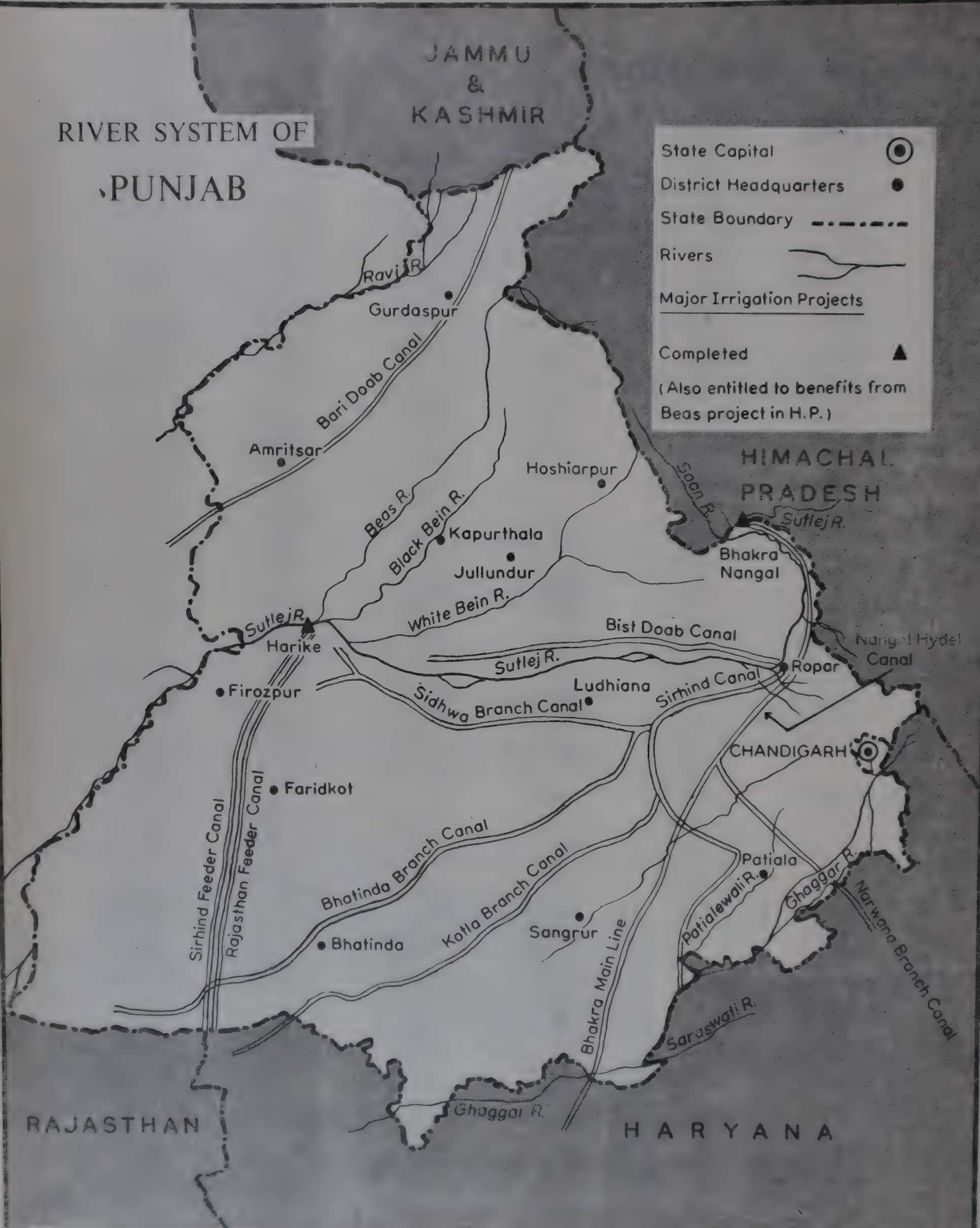
SOURCE: Government of Punjab, Economic and Statistical Organisation, **Statistical Abstract of Punjab, 1973**, February 1974, p. 113.

gated area. The proportion of the net irrigated area varied from 94 per cent in Amritsar district to just 29 per cent in Hoshiarpur district. The district-



Sprinkle irrigation.

RIVER SYSTEM OF PUNJAB



wise position of the net irrigated area is presented in Table 4.

The major sources of irrigation in Punjab are tubewells and canals. In 1972-73, these two sources respectively accounted for 56 per cent and 43 per cent of the State's net irrigated area.

The Irrigation Commission (1972) has estimated the ultimate irrigation potential, both from surface and ground-water resources, in Punjab at 5.04 million hectares. In 1972-73, the gross irrigated area was 77 per cent of the total gross cropped area. On the full development of this ultimate irrigation potential (5.04 million hectares), Punjab will have 95 per cent of the total gross cropped area under irrigation. The particulars of the major and medium irrigation projects in the State are indicated in Table 5.

Of the three rivers serving the State, the waters of the Sutlej have already been fully exploited by the construction of the Bhakra Nangal project. When the Beas project is completed, practically all the water available in the Beas will have been tapped. Only the water in the Ravi, which is around 7,808 million cubic metres (6.33 million acre feet), will remain to be utilised. It is, therefore, proposed to execute the

Brick-lined irrigation water channel to conserve water by preventing seepage



Table 5 : Major and medium irrigation projects
(Lakh hectares)

Project	Location of project		Ultimate irrigation potential in Punjab		
	River	District	Completed	Under execution	Total
*Bhakra Nangal	Sutlej	Bilaspur (Himachal Pradesh)	5.5	—	5.5
*Beas	Beas	Mandi (Himachal Pradesh)	—	4.8	4.8
Harike	Sutlej	Border of Amritsar, Firozpur and Kapurthala	0.1	—	0.1
Medium projects	Completed 8		1.0	—	1.0

NOTES : *Data for these projects are as at the end of August 1975. For other projects, the data relate to March-end 1973.

SOURCE : Ministry of Irrigation and Power, **Annual Reports** and other documents.

Table 6 : Villages without adequate drinking water facilities

District	Total number of villages in district	Population of all villages in district (Lakhs)	Villages without adequate drinking water facilities	
			Number	Population (Lakhs)
Bhatinda	519	8.45	533	8.71
Faridkot	564	9.24	505	8.09
Sangrur	709	9.14	521	7.10
Firozpur	1,084	8.13	328	4.17
Hoshiarpur	1,582	9.25	624	3.36
Ropar	870	4.66	455	2.82
Gurdaspur	1,526	9.80	395	2.46
Patiala	1,419	9.95	333	2.28
Amritsar	1,181	13.00	5	0.20
Kapurthala	526	3.30	1	0.02
Jullundur	1,209	10.17	Nil	Nil
Ludhiana	969	9.25	Nil	Nil
Total	12,188	103.35	3,700	39.21

Rs 146.54-crore Thein dam project to irrigate 3.49 lakh hectares. The project which envisages the construction of a dam across the river Ravi near Thein village in Jammu & Kashmir State, is considered essential for the total utilisation of the irrigation and power potential of the Ravi.

During 1974-75, the 12.87-km-long tunnel of the Rs 265-crore Beas-Sutlej project was completed. The tunnel with a diameter of 25 feet is the largest in Asia, and it will carry 9,000 cusecs of water from the Pandoh dam to the Sundranager hydel channel.

With a view to bringing more areas under irrigation, works on a number of irrigation projects are in progress. These projects include: the Rs 11.59-crore project for the diversion of the Shahnehar canal, the Rs 15.54-crore extension and improvement of the Shahnehar system to increase irrigation from 26,300 hectares to 1.33 lakh hectares, and the Rs 5.69-crore Dholbaha check dam to extend irrigation to 16,000 hectares.

In 1974-75, nearly 86 per cent of the potential created from surface waters through major and medium projects was utilised. Thus, there is very limited scope for further development of irrigation through such projects. So, the



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main emphasis will have to be on the extension of non-perennial irrigation to areas in the Upper Bari Doab Canal (UBDC) tract, the sinking of tubewells in this tract for stabilising and augmenting supplies in winter and other non-traditional methods.

Depending on the type of soils, it has been estimated that 25 to 70 per cent of irrigation water is being wasted through seepage in conveyance channels. This leads to waterlogging and salinity. By proper water management and land grading, it should be possible to irrigate an additional 25 to 70 per cent of the area with the same quantity of water.

Groundwater resources: The State possesses large resources of groundwater suitable for irrigation, except in some areas like Bhatinda and some parts of Firozpur and Amritsar districts where the sub-soil water is saline. Considering the recharge from rainfall, rivers and canals, the total estimated groundwater potential which can be safely drawn on a sustained basis is estimated to be about 11,101 million cubic metres (9 million acre feet). This quantity is sufficient for about three lakh tubewells/pumping sets and dug wells.

Our Chandigarh correspondent reports that the Water Resources Directorate has been making water table observations in the State since June 1971. From the data collected during the last four years, it has been noticed that the water table is generally falling in the districts of Jullundur, Hoshiarpur, Ludhiana, Sangrur, notably in Malerkotla block, parts of Faridkot, Amritsar and Ropar. It is, on an average, stable in parts of Patiala, Ropar and Amritsar districts and most of Gurdaspur district and is generally rising in the saline groundwater areas of Bhatinda, Firozpur and Faridkot districts. The depth of the groundwater table from the natural surface varies between 20 and over 100 feet in the Kandi areas of Gurdaspur, Hoshiarpur, Patiala, and Ropar and between 10 and 25 feet in the central plains—Amritsar, Gurdaspur, Hoshiarpur, Jullundur, Kapurthala, Ludhiana, Patiala, Ropar and parts of Faridkot, Firozpur and Sangrur districts. In the south-eastern parts, the depth is about 90 feet while in the riverine tracts, it is about 5 to 6 feet.

Floods: The problem of floods in the State is aggravated by the sudden change in the gradient as the rivers emerge from steeply sloping mountain valleys into gently sloping plains. Almost every year, floods cause damage to life and property and destroy kharif



Madhopur headworks over Ravi River near Pathankot.

crops over wide areas. It has been assessed that flood control and drainage schemes in the State would cost about Rs 80 crores. During 1975, the loss caused by floods to property and kharif crops in Amritsar and Gurdaspur districts exceeded Rs 10 crores. In all, 742 villages were affected, 22,872 houses collapsed or were damaged, 261 head of cattle perished and 28 human lives were lost.

Waterlogging: The recurrence of floods has a direct bearing on the extent of waterlogging in agricultural lands. The seepage from irrigation canals and irrigated lands also leads to waterlogging. The interference caused by embankments of canals, roads, railways, etc, contributes to the rise of groundwater and hence the waterlogging. The continued deforestation of the hills causes frequent flash floods in rivers and hill torrents which submerge the cultivated area. An area of 6 to 8 lakh hectares is prone to waterlogging.

Drinking water: Of the total number of 12,188 villages, 30 per cent of the villages covering two-fifths of the State's rural population suffer from inadequate drinking water supply. The district-wise data regarding drinking water facilities in rural areas as compiled by our Chandigarh correspondent are presented in Table 6.

Our Chandigarh correspondent further reports that the Punjab Government has formulated a scheme for pro-

viding piped water to about 3,700 villages in which there is acute scarcity of water or the underground water is unfit for drinking purposes because it is brackish or saline or it has excessive fluorides. He points out that out of 3,700 scarcity villages, water supply has already been made available to 882 villages.

What is the future plan for extending the drinking water facility? Our Chandigarh correspondent notes that it is expected that drinking water will be made available to another 400 villages by the end of 1975-76. Plans for the completion of the projects for supplying safe drinking water to all the villages in the State have not yet been finalised. The Government has announced its decision to set up 600 more deep tubewells in the State during the next two years for providing drinking water to the remaining areas. It was stated on October 22, 1975 that, so far, 500 tubewells have been set up for supplying drinking water to 1,500 villages at a cost of Rs 40 crores.

As for the supply of drinking water to urban areas, out of 108 towns, only one-third covering two-thirds of the State's urban population had either full or partial drinking water supply at the end of 1969 (Dave J. M., "The Progress of Community Water Supply in India", *Souvenir on United Nations Seminar on Water Resources Administration*, January 1973).

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RAJASTHAN

The challenge of desert

THE extensive arid zone of Rajasthan coupled with its scanty rainfall poses a challenge to this State. The execution of the prestigious Rajasthan Canal Project (based on the Sutlej waters), which is sure to become the lifeline of the State, is one of the major efforts in this direction. There has been even a suggestion to divert westward the surplus waters of the Ravi into Rajasthan to irrigate the desert. Also, in case the recommendations of the Khosla Committee regarding the sharing of the Narmada waters are implemented, it would help irrigate about 3.40 lakh hectares of land especially in the desert districts of Barmer and Jalore.

Rainfall: Among all the States, Rajasthan receives the lowest average annual rainfall of 46 cm (18 inches) with wide variations year by year and in its distribution within a season. As one moves from south-east to north-west, the rainfall rapidly decreases. From 100 cm (39 inches) in the hills of Jhalawar district in the south-east, the rainfall goes on decreasing to hardly 16 cm (6 inches) in the desert districts of Jaisalmer and Bikaner in the north-west. Again, 80 to 90 per cent of the rain is precipitated from June to September.

Drought-prone areas: About three-fifths of the total arid areas in the country fall in Rajasthan alone. About a third of the State is stark desert, and shifting sand dunes submerge the thin layer of good top-soil in adjoining areas. This classic arid region of the country is spread over the north-western districts of Barmer, Bikaner, Churu, Jalore, Jaisalmer, Jhunjhunun, Jodhpur, Nagaur, Pali, Sikar and Sirohi. Because of the scanty and erratic rainfall, drought conditions occur once in every three years in the eastern region and once almost every two years in the western region. The impact of drought over some earlier years is presented in Table 1.

In 1974-75, scarcity was declared in 19,861 villages, or 60 per cent of the total number of villages. Only two districts, Kota and Jhalawar, out of the 26 districts, were spared by the drought. The situation in Barmer and Jaisalmer was reported to be the worst.

Regarding the formation of the arid areas in the State, it is interesting

to note that in "ancient times the desert cradled what is known as the Harappa civilization. The genesis of the desert is ascribed to the drying up of the rivers that once flowed through this tract. It has been created by the north-easterly winds which blow from the direction of the Arabian Sea and the Rann of Kutch. These winds sweep the desert landscape for nearly eight months in the year, carrying with them a considerable bulk of sand particles. With no moisture or vegetation to hold the soil, even moderate winds gain momentum as they travel, ultimately turning into sandblasts... Sand dunes form a peculiar feature of the desert

Table 1: Impact of drought in Rajasthan

Year	Villages affected (Number)	Population affected (Lakhs)
1965-66	10,888	56
1966-67	9,715	45
1967-68	2,365	15
1968-69	22,799	132
1969-70	10,877	73
1970-71	503	3

SOURCE: Government of Rajasthan, Planning Department, **Rajasthan—Approach to the Fifth Five Year Plan**, July 1972, p. 5.

landscape, frequently rising to a height of 90 metres" (Dharam Pal, *Rajasthan*, 1968, p. 4).

According to the Irrigation Commission (1972), there are 19 chronically

drought-prone talukas in nine districts of the State (Table 2). They account

Table 2: Districts and talukas identified as chronically drought-affected

District	Talukas
I. Western desert	
1. Barmer	Barmer, Pachpadra, Sheopur
2. Bikaner	Bikaner, Kolayat, Lunkaransar
3. Churu	Dungargarh
4. Jaisalmer	Jaisalmer, Pokaran
5. Jodhpur	Phalodi
II. Hilly areas	
6. Ajmer	Ajmer, Beawar
7. Banswara	Bagidora, Garhi, Ghatol
8. Dungarpur	Aspur, Dungarpur, Sagwara
9. Udaipur	Kherwara

SOURCE: Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972, Vol. I, Appendix 8.1, p. 424.**

for more than 30 per cent of the total area and 12 per cent of the population of the State. In order to combat the recurrent droughts, the State government has decided to set up the Desert Development Board and has prepared plans for the drought-prone districts of Jodhpur and Nagaur with the World Bank assistance.

Groundwater resources: The total groundwater resources in the State have not been fully assessed so far; but a few indications are available. According to the Irrigation Commission (1972), the net groundwater recharge available for further groundwater development in Rajasthan is about 1.4 million acre feet and is the lowest among all the States. The State government in its *Approach to the Fifth Five Year Plan*



A view of Ramgarh dam, the major source of water supply to Jaipur

RIVER SYSTEM OF RAJASTHAN



0. 40) has stated that there will be 513 million cubic metres of groundwater available for minor irrigation through wells and tubewells. Also, recently, the Director of the Central Groundwater Board has disclosed that groundwater potential of 607 million cubic metres had been discovered in the desert area covering 40,852 sq km in Bikaner, Churu, Jhunjhun, Nagaur and Sikar districts. Further, an additional groundwater potential of 77.5 million cubic metres has been proved in Jaisalmer and Jodhpur districts in the arid zone. The groundwater department of the State government has also separately discovered another 500 million cubic metres of groundwater potential in the desert districts (*Amrita Bazar Patrika*, October 18, 1975). Therefore, Central and State geologists have suggested that detailed hydro-geological and exploratory drilling operations should be carried out for locating fresh water areas in saline tracts of the desert districts. The data collected from official sources by our Jaipur correspondent for district-wise average depth of groundwater are presented in Table 3.

Table 3 : District-wise average depth of groundwater

District	(Feet)		
	Low	High	Found mostly
Ajmer	20	150	40
Alwar	20	60	50
Banswara ..	5	50	15
Barmer	50	450	200
Bharatpur ..	10	200	40
Bhilwara ..	10	100	40
Bikaner	100	500	200
Bundi	10	400	100
Chittaurgarh ..	10	100	30
Churu	60	350	150
Dungarpur ..	10	50	15
Ganganagar ..	40	200	80
Jaipur	30	100	50
Jaisalmer	50	300	150
Jalor	30	90	60
Jhalawar	10	90	40
Jhunjhun	10	220	200
Jodhpur	30	400	200
Kota	10	150	50
Nagaur	20	350	100
Pali	10	150	50
Sawai Madhopur ..	10	300	50
Sikar	5	250	40
Sirohi	5	100	50
Tonk	10	50	25
Udaipur	50	90	50

Rivers: The drainage system in Rajasthan is largely determined by the watershed areas of the Aravallis. There

are mainly three river systems: (1) The Luni and its tributaries which drain the western slopes of the Aravallis and flow into the Arabian Sea, (2) the Mahi and the Sabarmati which drain the eastern slopes of the Aravallis and flow into the Arabian Sea and (3) the Chambal and its tributaries, the Kalisindh, Parwan and Parwati on the right bank and the Banas and its tributaries, the Khari, Mashhi, Morel, Berach on the left bank. But all these rivers are rain-fed and

Table 4 : Average annual flows of rivers in Rajasthan

River			Average annual flow (Million cubic feet)
Mahi	..	..	3,02,839
Chambal	..	..	1,53,605
Banas	..	..	1,41,177
Luni	..	..	29,398
Sabarmati	..	..	24,311
Kantli	Shekhawati rivers	..	9,926
Dohan		..	
Nawalgarh		..	
Krishnawati		..	
Ranoli		..	
Mehdha		..	
Other rivers	..	..	63,315
Total			7,24,571

SOURCE : Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 340

hence non-perennial. So, most of these rivers and their tributaries which carry the bulk of their flow during the monsoon season (Table 4) get either completely dry or become insignificant streams during the summer.

Irrigation: Rajasthan has an ultimate irrigation potential (surface as

well as groundwater) of 50 lakh hectares, i.e., the equivalent of one-third of the net sown area in 1970-71. Of this, about 43 per cent was utilised up to the end of 1970-71. Thus, only 14 per cent of Rajasthan's net sown area received irrigation in 1970-71, which was much lower than that in some of the adjoining States like Punjab (71 per cent) and Haryana (43 per cent). In other words, the remaining 86 per cent of the net sown area in the State is subject to the vagaries of the monsoon. Again, the entire irrigated area in the State falls under the low or medium rainfall region.

The main sources of irrigation are wells and canals. More than half of the irrigated area gets water from wells, and more than one-third from canals. The major and medium irrigation projects are mentioned in Table 5. Through all the major and medium irrigation projects, irrigation potential of 8.95 lakh hectares was created in the State up to the end of 1974-75, out of which 7.87 lakh hectares or about 88 per cent was utilised.

Among all the projects, the World Bank-aided Rajasthan canal project with its 6,000-km length of branches and distributaries and costing about Rs 325 crores is reported to be the biggest man-made channel of the world. The canal which will make the Thar desert bloom takes off from the Harike Barrage across the Sutlej river in Punjab. So far, Stage I costing Rs 170 crores has been completed and work on Stage II is in progress.

Recently, the soil and water management scientists in Kota have come out with very interesting infor-

Table 5 : Major and medium irrigation projects (Lakh hectares)

Project	Location of project		Ultimate irrigation potential in Rajasthan		
	River	District	Under		Total
			Completed	execution	
Rajasthan Canal (a)	Sutlej	Firozpur (Punjab)	—	12.7	12.7
Bhakra Nangal (a)	Sutlej	Bilaspur (Himachal Pradesh)	2.3	—	2.3
Chambal (a)	Chambal	Kota	—	2.3	2.3
Mahi	Mahi	Banswara	—	0.3	0.3
Gurgaon Canal	Yamuna	Rewari (Haryana)	—	0.2	0.2
Medium projects :	Completed	44	—	—	4.1
	Under execution	9	—	—	—

NOTES : (a) Data for these projects are as at the end of August 1975. For other projects, the data relate to March-end 1973.

(b) Rajasthan also receives benefits of Beas Project in Punjab and Gandhi Sagar Dam in Madhya Pradesh

SOURCE : Ministry of Irrigation and Power, Annual Reports and other documents

mation regarding the cause of obstruction in the flow of irrigation waters in the Chambal command area. According to the scientists, agricultural production in the command area is being hampered by aquatic weeds that choke the canals of the Chambal irrigation system, necessitating the annual closure of canals for removing weeds. The scientists further claimed that the weeds could be removed by simply introducing a lot of grass carp fish in the canals which are voracious weed eaters. In one trial, 19 fish ate all the weeds in a 480-sq-metre area in just five days. Such a preventive measure would help avoid the annual closure of canals and raise a third crop in the area (*The Financial Express*, January 17, 1974).

Floods: Though normally the State presents a picture of a dry and dusty landscape, flash floods are also not a rarity. For example, floods in the Banas, the Chambal and the Luni rivers during the 1975 monsoon are reported to have killed 45 persons and affected 5.56 lakh people in 870 villages. Standing crops worth Rs 35 crores on 73,000 hectares of land were completely lost, and about 23,000 houses damaged in eight of the 26 districts. The total loss to crops, roads and houses is estimated to be Rs 50 crores.

Table 6 : Villages without adequate drinking water facilities

District	Total number of villages in the district (1971)	Population of all villages in the district in 1971 (Lakhs)	Villages without adequate drinking water facilities	
			Number	Population (Lakhs)
Ajmer	954	7.16	55	1.00
Alwar	1,869	12.64	270	2.00
Banaswara	1,439	6.21	Nil	Nil
Bharatpur	1,868	12.85	53	1.00
Bhilwara	1,508	9.39	51	1.90
Bikaner	540	3.36	80	1.10
Barmer	837	7.19	66	1.30
Bundi	729	3.83	98	0.52
Chittaurgarh	2,123	8.47	202	1.94
Churu	850	6.16	107	1.00
Dungarpur	825	4.99	Nil	Nil
Ganganagar	2,386	11.64	109	1.66
Jaipur	2,683	17.37	837	5.20
Jaisalmer	432	1.42	34	0.16
Jalor	595	6.38	60	1.28
Jhalawar	1,441	5.63	17	0.56
Jhunjhunun	693	7.67	303	3.08
Jodhpur	702	7.85	141	2.07
Kota	1,905	8.69	53	1.45
Nagaur	1,216	11.07	107	2.06
Pali	824	8.62	168	2.97
Sawai Madhopur	1,531	10.51	171	1.92
Sikar	810	8.65	69	2.19
Sirohi	423	3.48	25	0.62
Tonk	1,006	5.17	64	0.68
Udaipur	3,116	15.82	80	3.04
Rajasthan	33,305	212.22	3,220	41.31

Drinking water: According to the data collected by our Jaipur correspondent, out of the 33,305 villages (1971)

in the State, about one-tenth of the villages, covering nearly one-fifth of the State's rural population, had adequate drinking water facilities. The district-wise water supply position in rural areas is shown in Table 6.

At the end of 1974-75, in all 1,329 villages, covering a population of about 29 lakhs, were provided with protected drinking water supply. In addition, 504 villages with a population of 5 lakhs would be given piped water facilities during 1975-76 as per government sources. On November 2, 1975, the Chief Minister, Mr Harideo Joshi laid the foundation stone for the Rs 6.0 crore Lakhuwali-Taranagar drinking water supply scheme at Sahwa in Churu district. On completion of the scheme in about six years, 234 villages in Churu district will get drinking water. Recently, the State government is reported to have also approved the following two drinking water supply schemes for rural areas in Jalor district: (1) the Rs 22-lakh Bagora-Korwar scheme and (2) the Rs 9-lakh Karwara-Sarwara scheme.

As for towns, at the end of 1969 more than 68 per cent of the towns received either full or partial water supply (Dave J. M., "The Progress of Community Water Supply in India" which appeared in *Souvenir on United Nations Seminar on Water Resource Administration*, January 1973).

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TAMIL NADU

Little scope along conventional lines

TAMIL NADU, situated at the south-eastern tip of the Indian peninsula, is favourably conditioned by rainfall and rivers. Unlike the other States, it has two monsoons—the north-east monsoon and the south-west monsoon. The Cauvery which cuts across the State forms the core of the State's river system. After Punjab and Haryana, Tamil Nadu is the most irrigated State of the Indian Union and is in the forefront with Kerala in utilisation of ultimate irrigation potential. The State has also the distinction of being one of the few states which have utilised their surface water resources to the maximum possible extent. If this is a laudable achievement, it also signifies that there is not much scope for getting more water through conventional means to meet the increasing need.

Rainfall: Tamil Nadu receives, on an average, a moderate rainfall of 97 cm (38 inches), both from the south-west and the north-east monsoons. Unlike the rest of the country, the State normally receives half of its annual precipitation from the north-east monsoon (October-December). However, the rainfall varies according to the physiographic regions such as coastal plains, the Eastern Ghats, central plateau and the Western Ghats, and its incidence is most irregular.

Large tracts come under the rain-shadow of the Western Ghats, and the rainfall in these semi-arid areas is between 50 cm and 100 cm (20 and 39 inches). On the other hand, the districts of Thanjavur, South Arcot, Chingleput and North Arcot receive higher rainfall as they get a fairly well distributed rainfall from both the monsoons. The highest rainfall, varying between 145 cm and 190 cm (57 and 75 inches), is received in Nilgiris and Kanyakumari districts, while it is the least in Tirunelveli, Coimbatore, Tiruchirapalli and Ramanathapuram districts which receive rain only from the north-east monsoon.

Rivers: Almost all the rivers flowing through the State rise either in Karnataka or in Kerala. The Cauvery is the most important river in the State. Other rivers are the Palar, the Ponnaiyar, the Vellar, the Vaigai and the Tambraparni. The Cauvery is one

of the best regulated and fullest exploited rivers in India. It drains an area of 48,770 sq km through its passage of 416 km in the State before meeting the Bay of Bengal. In Tamil Nadu, its tributaries are the Bhavani, the Noyil, and the Amaravathi. All

Table 1: Annual and seasonal flows of rivers in Tamil Nadu

River	Total flow (Million cubic metres)	Percentage of yield		
		June-Sep	Oct-Dec	Jan-May
Cauveri				
(a) Mettur Reservoir ..	10,785	68	24	8
(b) Grand Anicut ..	11,002	57	33	10
(c) Coleroon ..	4,413	43	45	12
Bhavani ..	2,274	53	29	18
Amaravathi ..	667	30	54	16
Palar ..	135	7	90	3
Pennaiyar ..	634	15	74	11
Vaigai ..	1,102	25	49	26
Tambraparni ..	821	17	55	28

SOURCE: Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 336

these rivers are rain-fed, and hence their maximum discharge occurs during the monsoon months. Except the Cauvery and the Tambraparni which have substantial flows even during the sum-

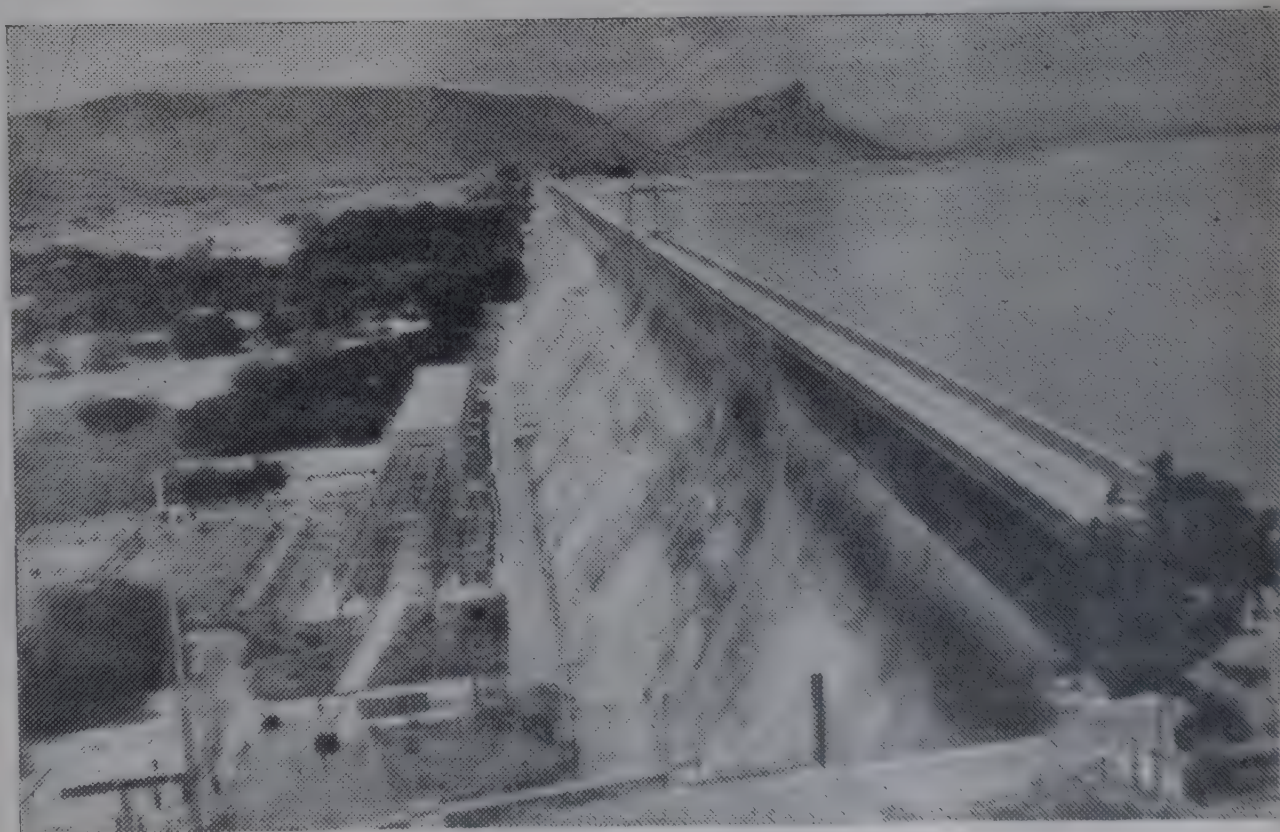
mer, all other rivers almost completely dry up during the summer months. The annual and seasonal flows of rivers at certain selected sites are shown in Table 1.

The State has a long-pending dispute with Karnataka and Kerala over the use of the Cauvery waters. Even after a series of talks among the three State Chief Ministers, the latest in February 1975, the dispute remains unresolved.

Irrigation: From the agricultural angle, almost four-fifths of the net sown area and the net irrigated area come under the medium rainfall zone (75 cm to 115 cm or 30 to 45 inches), and the remaining one-fifth under the high rainfall zone (above 115 cm or 45 inches).

The Irrigation Commission (1972) reports that Tamil Nadu has an ultimate irrigation potential (surface as well as groundwater) of 36 lakh hectares or the equivalent of 58 per cent of the net sown area in 1970-71. During 1970-71, it was the only State utilising more than 72 per cent of this irrigation potential. As a result, barring Punjab (71 per cent) and Haryana (43 per cent), Tamil Nadu had the highest percentage of the irrigated area (42 per cent) to the net sown area in 1970-71. It is also one of the few States where irrigation from different sources is more or less evenly distributed: tanks (35 per cent), canals (34 per cent) and wells (30 per cent).

The major and medium irrigation projects in the State are shown in Table 2. Among the projects shown in Table 2, Parambikulam Aliyar is



Mettur dam, the biggest major irrigation project in Tamil Nadu.

RIVER SYSTEM OF TAMIL NADU

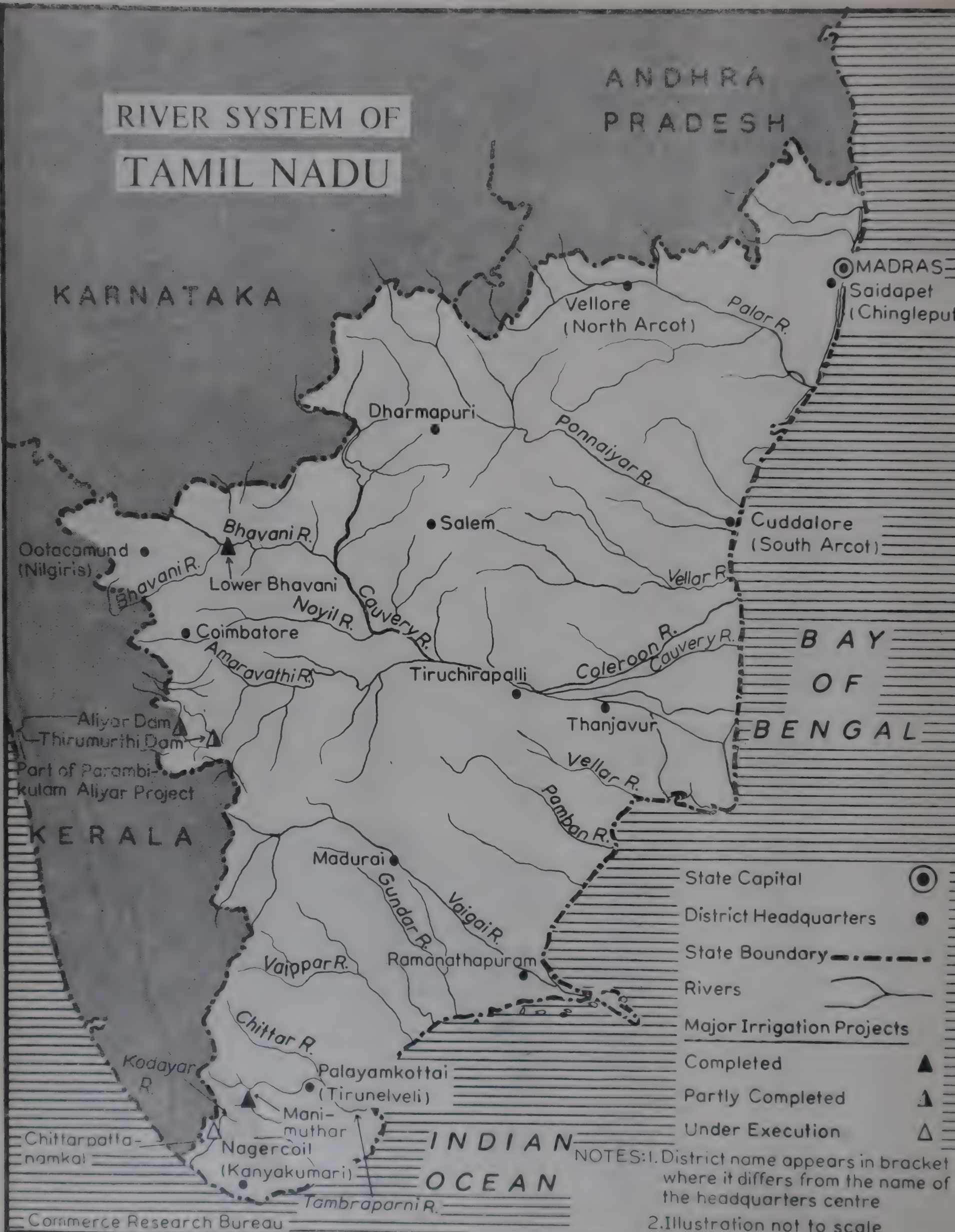


Table 2: Major and medium irrigation projects : March-end 1973

(Lakh hectares)

Project	Location of project		Ultimate irrigation potential in Tamil Nadu		
	River	District	Completed	Under execution	Total
Parambikulam Aliyar		Coimbatore/Palghat (Kerala)	0.9	0.1	1.0
Lower Bhavani	Bhavani	Coimbatore	0.8	—	0.8
Manimuthar	Manimuthar	Tirunelveli	0.4	—	0.4
Chittarpattanamkal	Chittar	Kanyakumari	—	0.1	0.2
Medium projects:	Completed	15	—	—	0.9
	Under execution	12			

NOTE: *The project is an inter-State project with Kerala and the data relate to August-end 1975

SOURCE: Ministry of Irrigation and Power, **Annual Reports** and other documents

The biggest and most ambitious project which envisages harnessing of as many as seven rivers, viz, the Ninar, the Sholayar, the Parambikulam, the Anakadavu, the Peruvuripallam, the Aliyar and the Palar. It is perhaps the only project in the country in which planning is being done almost throughout the distribution system.

During 1974-75, the State utilised almost 96 per cent of the surface water now available for irrigation through the execution of major and medium irrigation projects. As such, there is very little scope for further exploitation of surface water resources. Hence, the future expansion of irrigation will have to depend largely on the exploitation of groundwater through minor irrigation schemes and other non-conventional measures of water conservation, including the diversion of flood waters of the Cauvery to the drought-prone district of Ramanathapuram and also the linking of the Ganga with the Cauvery.

The Ganga-Cauvery link, a component of the proposed national water grid, envisages the diversion of about 10 million to 20 million acre feet of water, that is only half a per cent of water that goes waste, from the Ganga at Patna, during the monsoon months through the construction of a grand feeder canal of about 3,000 km reaching up to the Mettur dam on the Cauvery in the south. This would, *inter alia*, supply water to the drought-prone areas of southern Uttar Pradesh and Bihar and also the chronically drought-affected regions of Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu. This link is indeed grandiose in magnitude as it envisages one of the biggest man-made canals in the world. The Ganga-Cau-

very link, apart from creating additional irrigation facilities and employment opportunities, will be a positive step in the direction of developing and utilising the water resources of the country in the best possible national interests. Thus, it will be a bulwark of national integration also.

Groundwater resources: According to the Irrigation Commission (1972), Tamil Nadu (including Pondicherry) has a net groundwater recharge of 11.5 million acre feet, after making allowance for evapo-transpiration and sub-surface run-off losses. Out of this, even if 3.5 million acre feet is considered to be the annual draft, the State will still have eight million acre feet of net groundwater recharge available for further groundwater development. Recently, the Geological Survey of India is reported to have identified a 20-km groundwater belt at Thiruvannamiyur-Kovalam coastal area.

The Tamil Nadu Government feels that groundwater resources should be

economically used, and wastage and a conflict of interests should be avoided. The Groundwater Directorate has, accordingly, prepared a draft Bill to regulate the use of groundwater resource, and the State Government is examining the draft Bill. As the basis for the proposed regulation of groundwater, the Groundwater Directorate is preparing a water atlas for each district giving its groundwater potential. Another important step the Tamil Nadu Government is to take soon is the setting up

Table 3: Drought-affected talukas in Tamil Nadu

District	Talukas
1. Coimbatore	Avanashi, Dharapuram, Palladam
2. Dharmapuri	Dharmapuri, Harur, Hosur, Krishnagiri
3. Madurai	Dindigul, Palani, Tirumangalam
4. Ramanathapuram	Aruppukkottai, Mudukalathur, Paramakudi, Ramanathapuram, Sattur, Thiruvadanai
5. Salem	Sankari, Tiruchengode
6. Tiruchirapalli	Alangudi, Karur, Kulathur, Perambalur
7. Tirunelveli	Kovilpatti, Nanguneri

SOURCE: Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972, Vol. I, Appendix 8.1, p. 424**

of a water institute whose main object will be the formulation of broad principles for planning and management of water resources and assisting the Government in evolving requisite policies.

Drought-prone areas: Over large tracts of the State in the rain-shadow of the Western Ghats, the rainfall is deficient and uncertain. The Irrigation Commission (1972) has identified 24 talukas in seven districts of the State as drought-prone (Table 3). All these talukas account for about one-fourth of



Manimuthar dam, a minor irrigation work in Tamil Nadu.

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area and one-sixth of the State's population. The year 1974 was marked by the failure of the north-east monsoon. During October-December 1974, the State received 60 per cent less than normal precipitation, which led to widespread drought conditions throughout the State. This deficiency in rainfall is reported to be the highest since 1966. Over two-thirds of the total number of villages, covering about 10 million or one-fourth of the State's population, were affected by drought. The condition was reported to be grave, particularly in the districts of Dharmapuri, Pudukottai and Ramanathapuram.

Drinking water supply: Our Madras correspondent writes that traditional drinking water sources in the rural areas of the State are irrigation tanks, channels and wells. The tanks and channels are seasonal. They are also vulnerable to pollution and have been responsible for the endemicity of cholera and guinea-worm disease.

Table 4: Villages and hamlets without adequate drinking water facilities

District	Total number of villages and hamlets in the district	Number of villages and hamlets without adequate drinking water facilities
Chingleput ..	3,315	2,327
Coimbatore ..	6,052	1,887
Dharmapuri ..	3,555	1,290
Kanyakumari ..	1,288	520
Madurai ..	4,550	1,805
Nilgiris ..	740	257
North Arcot ..	3,441	826
Pudukottai ..	3,008	1,734
Ramanathapuram	5,838	3,690
Salem ..	3,543	1,168
South Arcot ..	3,652	1,331
Thanjavur ..	4,852	2,927
Tiruchirapalli ..	3,487	1,243
Tirunelveli ..	3,763	1,082
Total ..	51,084	22,087

in many villages. Wells have been a comparatively better source, but, due to the low rainfall, they have to be dug very deep. Thus they become so costly that many villages cannot afford to have them. Moreover, these wells very often dry up in summer.

Another problem has been that of locating successful wells in the hard rock areas. These areas cover about 75 per cent of the State. In the hard rock areas, sophisticated technology consisting of electrical resistivity surveys and other similar methods are required for locating successful wells, and, owing to their absence in rural areas, wells

A row of taps in a village



have been dug or deepened in hard rock at considerable expense without any tangible benefit. In villages in the coastal areas, salinity poses another problem. In certain isolated pockets in Salem and in Pollachi taluka, excess fluoride is present in groundwater, and the rural population has been afflicted with fluorosis.

As can be seen from the data collected from official sources by our Madras correspondent (Table 4), of the total number of 51,084 villages and hamlets, 22,087 or 43 per cent do not have adequate drinking water facilities. Out of these 22,087 villages and hamlets, about 5,100 are estimated to be in the scarcity category (they do not have any source of water within a reasonable distance of 1-2 km), about 2,200 under the endemic category (they are prone to water-borne diseases, like cholera, typhoid, guinea worm disease, etc.) and about 15,000 in the inadequate water supply category (they have some sources of water supply but the sources are inadequate and mostly dry up in summer). All these villages and hamlets cover a population of about 115 lakhs.

It has been estimated by the State Planning Commission that Rs 10 crores will be required to give protected water

supply to the endemic and scarcity areas and Rs 10 crores for covering villages with inadequate water supply. Top priority has been given to scarcity and endemic areas, and it is proposed to complete this task by the end of the Fifth Five Year Plan. A comprehensive rural water supply programme has been in operation in the State since 1971-72, with the formation of the Tamil Nadu Water Supply and Drainage Board (TWAD). The programme is oriented mainly to borewell sources.

A comprehensive rural water supply scheme is being carried out under three programmes.

1. The UNICEF-assisted programme envisages the sinking of 8,850 borewells in the endemic and hard rock areas of the State. The UNICEF has been aiding the State by supplying equipment.
2. The Accelerated Programme was introduced by the Government of India in 1972. The main objective of this programme was to take up water supply schemes in regions where the public is in urgent need of assured supply of safe drinking water. Under this programme, the Government of India has sanctioned 421 schemes. The State also has sanc-

tioned 345 schemes on its own. New Delhi has given Rs 1.75 crores for this programme, and the balance of the cost is being met by the State.

3. The Minimum Needs Programme which was launched in 1974-75 is fully financed by the State Government. It envisages provision, by the end of 1978-79, of drinking water to those endemic and scarcity villages which are not covered by the other two programmes.

An expenditure of Rs 10 crores has been incurred on the rural water supply programme in the State since the formation of the TWAD. So far, 3,200 villages, with a population of 22.50 lakhs have been provided with water under this comprehensive programme.

As regards urban water supply, the information received from our Madras

correspondent indicates that protected water is provided in both the corporation cities, 83 cities having municipalities, five municipal townships, eight panchayat townships and 89 town panchayats, which cover 70 per cent of the urban population of the State. Water supply schemes are under execution in about 110 towns. In addition, it is proposed to extend this facility to another 250 towns. As per the Perspective Plan for Tamil Nadu 1974-84, though about 70 per cent of the urban population receives protected water supply, the supply is not adequate. It is proposed to implement programmes for supplying 25 gallons of water per day per capita. These programmes will cover a population of 56 lakhs.

The failure of the north-east monsoon in the winter of 1974 caused acute drinking water scarcity throughout the

State, particularly in the urban areas. Even Madras, the State capital, with a population of about three million experienced the worst ever famine, during which it used only 30 million gallons of water on alternate days, i.e., only half the minimum requirement. In many areas water was supplied once in even days or even ten days.

With a view to finding a solution to this problem, the Government carried out artificial rain-making experiments, with the help of American experts. These experiments were reported to be successful. Some of the water supply schemes undertaken under the TWAD are: (1) the Rs 52-crore scheme for Kangeyam town, (2) the Rs 1.71-crore Siruvani water supply scheme for Coimbatore town and (3) the Veeranam project.

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UTTAR PRADESH

Abundant water resources but poor management

HERE are very few areas in the whole world, let alone India, which are so well endowed in terms of fertile soil and water as Uttar Pradesh. No wonder, therefore, that throughout the last 3,000 years of history, this area has been the premier agricultural region of India, sustaining the largest population among all States. At the same time, the low per capita income and poverty are indicative of the fact that the available excellent soilwater resources are not fully exploited. Thus, for example, during the monsoon, most of the abundant surface waters of this State cause floods and inundate large tracts and then drain into the Bay of Bengal. The groundwater resources, though the largest in the country, are not adequately conserved and tapped. This calls for management of available water resources in a scientific and well planned manner.

Rainfall: On an average, the annual rainfall in the State is 117 cm (46 inches) which varies from region to region depending upon the topography. The rains are brought by the Bay of Bengal current of the monsoon and caused by the obstruction of the high mountain wall of the north. So, the largest amount of rainfall is to be found in the valleys of Naini Tal, Dehra Dun and Garhwal districts situated in the Himalayan hills. The rainfall generally decreases from north to south and east to west. The normal rainfall in the eastern region is 111 cm (44 inches), the western plains 92 cm (36 inches) and western hilly tracts 179 cm (70 inches). The State gets about 87 per cent of the precipitation during the monsoon months of June to September. Winter rains, though small in quantum, are very useful for standing rabi crops.

With the exception of a few areas, the variability of the annual rainfall is very high in the entire western plain, the central plain and the Vindhya hills and plateau region.

Rivers: Between the Himalayas in the north and the southern hills and plateau in the south lies the alluvial Gangetic plain which covers the bulk of the State's area. The plain is chiefly drained by the Ganga, the Yamuna, the Ramganga, the Gomati and the Ghaghara from west to east. All these

rivers, except the Gomati, emerge from the Himalayas and hence are perennial. The south-western region consisting of the Vindhyan hills and the plateau is drained by the Chambal, the Sind, the Son, the Betwa and the Ken. Eventually, all rivers flow into the Ganga—the Yamuna with its tributaries at Allahabad and the Ghaghara with all its accumulated waters near Ballia.

Table 1: Salient features of principal rivers in Uttar Pradesh

River	Catchment area (Sq km)	Average annual flow (Million cubic metres)
Ganga	32,357	9,371
Betwa	26,893	7,022
Ken	18,429	5,256
Yamuna	18,250	9,371
Sarda	15,165	31,342
Dhāsan	7,348	N.A.

SOURCE : Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 392

The Himalayan rivers are more active than those coming from the Vindhyan range in filling up the great plain with silt, and they also provide more important sources of irrigation.

Table 1 gives the salient features regarding the catchment area and the average annual flow of some of the rivers at certain specific points in Uttar Pradesh.

Floods: The flat nature of land and want of drainage channels are mostly responsible for the intensity of floods. In the central plain the Ganga, the Yamuna, the Sarda and the Ghaghara and their tributaries are flooded during the monsoon thereby eroding and overflowing their banks; while in the eastern region, the floods are mainly due to the high intensity of rainfall, poor land slopes, a high sub-soil water level, accumulation of detritus in river beds and a number of depressions which are difficult to drain off. The area affected by floods varies from about 10 lakh hectares during a year of low flood to 40 lakh hectares during a year of high flood. Our Lucknow correspondent has

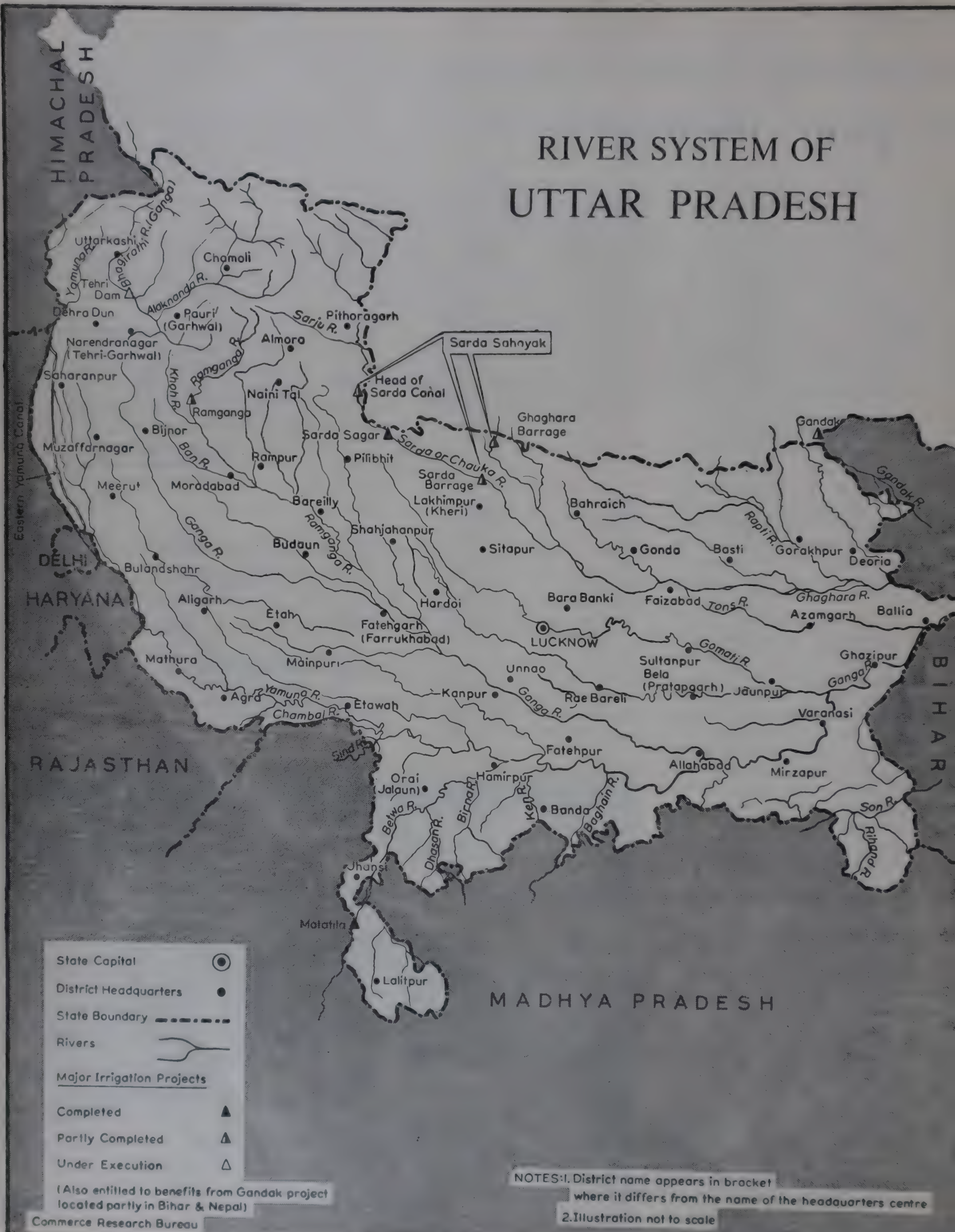
Table 2: Average annual flood damage in Uttar Pradesh : 1953-72

Item	Average annual damage	Maximum damage (Year)
Area affected (Lakh hectares)	18.7	52.6 (1971)
Cropped area affected (Lakh hectares)	9.5	26.5 (1971)
Population affected (Lakhs)	62.5	208.1 (1971)
Human lives lost (Number)	160	605 (1971)
Cattle head perished (Number)	1,673	5,694 (1955)
Damage to houses (Lakh numbers)	2.3	7.7 (1955)
Total damage (Rs crores)	28.5	174.5 (1971)



Kishanpur pump canal on the border of Allahabad and Fatehpur districts.

RIVER SYSTEM OF UTTAR PRADESH

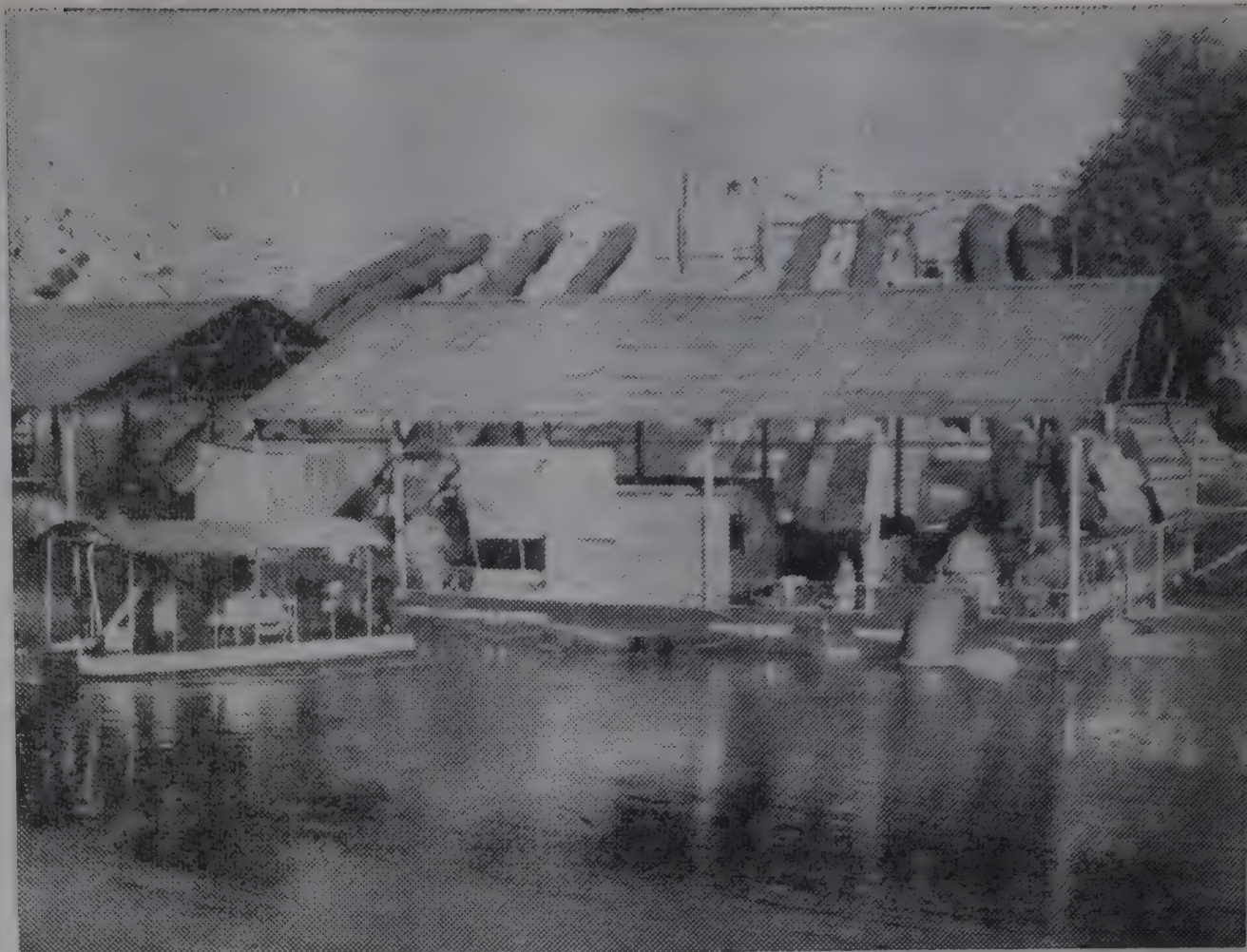


provided some revealing data about the average annual flood damage in the State during 1953-72, which is presented in Table 2.

During the 1975 monsoon season also, the State was hit by severe floods in which more than 30 lakh people in 657 villages of the 10 eastern districts were affected and eight lakh hectares of land was submerged. According to Mr Kedarnath Singh, Union Deputy Minister for Agriculture and Irrigation, the total loss caused by the floods during 1975 has been estimated at more than Rs 235 crores.

Groundwater resources: Our Lucknow correspondent has reported that the Uttar Pradesh Groundwater Investigation Organisation (GIO), established in 1972, has calculated with certain reasonable assumptions that groundwater which is available through rainfall and percolation is 50.55 lakh hectare metres, and the total recharge available for exploitation is 69.20 lakh hectare metres. The total consumption of groundwater due to dug wells, pump-sets, shallow and deep tubewells, during 1973, was 23.55 lakh hectare metres. At the same time, the GIO has identified a few pockets in six districts of the State, i.e., Aligarh, Budaun, Bulandshahr, Meerut, Muzaffarnagar and Varanasi, where the water levels have gone down by about two metres due to excessive exploitation of groundwater.

However, there are great possibilities for underground storage. According to the study by Roger Revelle and V. Lakshminarayana, *The Ganges Water Machine*, infiltration into the water table in the monsoon could be increased by (a) water spreading in the piedmont deposit north of the Terai belt of springs and marshes; (b) constructing bunds at right angles to the flow lines in uncultivated fields to slow down run-off and increase infiltration; (c) pumping out the underground



Dalmau pump canal in Rae Bareilly district (UP)

aquifers during the dry season in the neighbourhood of nullahs (natural drains) which carry water during the monsoon; (d) pumping out groundwater during the dry season along certain tributaries of the Ganges to provide space for groundwater storage; and (e) increasing seepage from irrigation canals during the monsoon season by extending the network of canals, distributaries and water courses for kharif irrigation and pumping out this seepage water during the dry season. These measures would help prevent floods and increase the agricultural potential in the Ganga basin.

Irrigation: More than two-fifths of the State's net sown area receives irrigation. The State ranks fourth after Punjab, Haryana and Tamil Nadu among all the States in the country in this respect. Also, more than four-

fifths of the net sown area and three-fourths of the net irrigated area fall under the high rainfall (above 115 cm or 45 inches) and medium rainfall (75 cm to 115 cm or 30 to 45 inches) regions. Though the western region of the State receives less rainfall than the eastern region, water resources in relation to agriculture are better placed in the western region because of an excellent irrigation network, initiated more than a century ago.

Table 4: Gross water requirement in Uttar Pradesh: 1970-71 to 2000-01

('000 hectare metres)

Requirement purpose	Year		
	1970-71	1973-74	2000-01
Irrigation	5,150	6,433	17,005
Nuclear power ..	—	193	1,778
Industry	45	75	927
Domestic	127	137	364
Livestock	72	74	107
Total	5,394	6,912	20,181

Table 3: Major and medium irrigation projects : August-end 1975

(Lakh hectares)

Project	Location of project		Ultimate irrigation potential in Uttar Pradesh		
	River	District	Completed	Under execution	Total
Sarda Sahayak	Ghaghara	Kheri	1.3	13.7	15.0
Ramganga	Ramganga	Garhwal	2.7	3.0	5.7
Gandak	Gandak	Gorakhpur	2.7	0.4	3.1
Tehri Dam	Ganga	Tehri-Garhwal	—	2.	2.7
Matatila	Betwa	Jhansi	1.2	—	1.2
*Medium projects:	Completed	53 }	—	—	10.8
	Under execution	11 }			

NOTE : *Data for these projects are as at the end of March 1973.

SOURCE : Ministry of Irrigation and Power, Annual Reports and other documents

According to the Irrigation Commission (1972), Uttar Pradesh has the largest surface and groundwater resources in the country, i.e., 151 lakh hectares or 87 per cent of the net sown area in 1970-71. About half of this potential was utilised in 1970-71. Thus, the State ranked third in the country after Tamil Nadu and Punjab in this

pect. It is estimated that out of the total water resources in the Ganga basin, Uttar Pradesh accounts for more than 70 per cent.

Wells are the most important source of irrigation in the State. This source accounts for 56 per cent of the State's irrigated area, followed by canals (35 per cent). According to a preliminary assessment by the State Government there is a groundwater potential of 28.54 lakh hectares in the State which can be utilised for irrigation through wells and tubewells.

The position of major and medium irrigation projects as at the end of August 1975 is indicated in Table 3.

In addition to the projects mentioned in Table 2, two more projects, namely, the Rs. 5-crore barrage across the river Kosi, a tributary of the Ramganga, at Ramnagar in Naini Tal district and the Rs 2-crore pump canal at Kishanpur in Fatehgarh district were inaugurated recently. Among the medium projects, the Dalmau pump canal stage II (Rae Bareilly district), the Chillimal pump canal (Banda district) and the Yamuna pump canal are important schemes under execution. The State Government has proposed several irrigation and pump-canal projects. Important among them are: Pancheshwar Dam, Lakhwar Dam and Kishan Dam.

According to the data collected by our Lucknow correspondent, the assessed gross water requirement of the State for various purposes at the end of the 20th century is presented in Table 4.

Drought-prone areas: Drought conditions are confined to certain pockets in the State where the rainfall is low. These areas cover the whole of Mirzapur district, Naughar area in Chandauli taluka of Varanasi district, Meja taluka and Bara Pargana in Karchhana taluka of Allahabad district and some areas in Karwai and Mau talukas of Banda district. These drought-prone areas constitute a part of the Vindhyan plateau and their terrain is rocky. The groundwater available here is mostly in fissures and deep pockets. As a result, the sinking of tubewells or open wells is not feasible in these areas.

Drinking water supply: According to the information received from our Lucknow correspondent, nearly 30 per cent of the State's rural population faces acute shortage of drinking water. The nature of the problem varies from place to place according to geographical and geo-hydrological conditions. Our corres-

pondent further states that the Engineering Department of the State's Local Self-Government, in its detailed survey conducted in 1963, has identified 35,506 villages as scarcity villages. Out of these 35,506 villages, piped water supply was available to 4,560 villages at the end of March 1975. Some of the problems faced by these villages in getting drinking water in different regions of the State are briefly discussed below.

(a) **Hill areas:** Many villages in these areas are located at elevations varying between 1,000 and 3,000 metres. In most cases people have to go as far as five km to fetch water from the available sources. Of the total number of 7,771 villages affected by scarcity, only 2,479 villages receive piped water supply.

(b) **Rocky area along Vindhyan ranges:** Drinking water has to be

obtained from open wells which dry up during the summer. Acute shortage of water affects people in 7,541 villages, out of which only 1,816 villages have been provided with potable water.

(c) **Bhabhar area:** The topography of this area is sub-mountainous and undulating. The sub-soil water level in some of the villages varies from 50 to 100 metres. In a large number of villages people are forced to extract water from the slush by digging the beds of dried up rivulets. Of the 129 scarcity villages in the area, only 23 villages have drinking water supply.

(d) **Drought-prone areas:** Nearly 33.4 lakh people in the area face near-famine conditions due to the abnormal lowering of the water level during drought years. Of the 2,110 problem villages, only 90 villages have been provided with piped water supply.

Table 5: Villages without adequate drinking water facilities in Uttar Pradesh

Region/District	Total number of villages 1971	Number of villages without adequate drinking water facilities	Region/District	Total number of villages 1971	Number of villages without adequate drinking water facilities
Hill areas			Other problem areas		
1. Almora	3,576	1,821	Aligarh	1,717	159
2. Chamoli	1,488	761	Azamgarh	4,943	500
3. Dehra Dun	767	450	Bahraich	1,884	891
4. Naini Tal	1,771	1,648	Ballia	1,912	600
5. Garhwal	3,236	862	Bara Banki	2,047	319
6. Pithoragarh	1,542	1,035	Bareilly	1,922	721
7. Tehri-Garhwal	1,958	830	Basti	6,942	3,000
8. Uttar Kashi	672	364	Budaun	1,814	742
Sub-total	15,010	7,771	Bulandshahr	1,537	—
Rocky areas along Vindhyan ranges			Deoria	3,559	1,572
1. Allahabad	3,534	1,306	Etah	1,524	41
2. Banda	1,207	650	Etawah	1,477	549
3. Hamirpur	930	573	Faizabad	2,654	199
4. Jalaun	957	699	Farrukhabad	1,626	565
5. Jhansi	1,450	887	Fatehpur	1,352	80
6. Lalitpur	2,993	1,910	Gonda	2,814	344
7. Mirzapur	3,647	1,516	Gorakhpur	4,091	1,256
8. Varanasi	—	—	Hardoi	1,879	391
Sub-total	14,718	7,541	Kanpur	1,898	79
Bhabhar area			Kheri	1,670	726
1. Bijnor	2,102	18	Lucknow	907	7
2. Saharanpur	1,688	111	Mainpuri	1,386	389
Sub-total	3,790	129	Meerut	1,501	—
Drought-prone area			Moradabad	2,459	533
1. Ghazipur	2,510	1,110	Muzaffarnagar	927	—
2. Jaunpur	3,226	1,000	Pilibhit	1,156	543
Sub-total	5,736	2,110	Pratapgarh	2,195	109
Brackish and excessive fluoride area			Rampur	1,092	586
1. Agra	1,182	688	Shahjahanpur	2,088	387
2. Mathura	884	556	Sitapur	2,329	475
3. Rae Bareilly	1,749	757	Sultanpur	2,491	99
Sub-total	3,815	2,001	Unnao	1,699	92
			Sub-total	69,492	15,954
			Total	1,12,561	35,506

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(e) *Brackish and excessive fluoride area*: Though there is no dearth of water in this area, the water has excessive fluoride content and is brackish and unpotable. Out of 2,001 such villages only 16 villages get safe water supply.

The Engineering section of the Local Self-Government Department has proposed to provide piped water by the end of the Fifth Plan to 22,682 villages which suffer from scarcity of potable water. It is negotiating with the World Bank a loan of about Rs 27 crores partly meeting the estimated expenditure of Rs 200 crores. The State Government has also planned to cover 9,000 villages under the rural water supply scheme during the Fifth Plan. The region-wise and district-wise position of water supply in rural areas is shown in Table 5.

As for the provision of drinking water in urban areas, water availability in the KAVAL towns—Kanpur, Allahabad, Varanasi, Allahabad and Lucknow—is on a low scale and in some parts, the population is not at all provided with this facility. The International Development Association (IDA), an affiliate of the World Bank, has approved a credit of about Rs 36 crores to improve water supply and sewerage facilities in Uttar Pradesh. The project envisages the construction of piped water supply schemes in some rural areas to benefit 12 lakh people in 2,000 villages served by the regional *Jal Sansthan*s and improvement in the quality of water supply and sewerage systems in the KAVAL towns.

Pollution: According to the findings of a survey conducted recently by a team of scientists from the National Environmental Engineering Research Institute, Kanpur, in nine sugar mills in the State to study the pattern of effluent treatment and its disposal, waste effluents from almost all the mills were being discharged untreated either on land or into water courses. The findings also revealed that the dilapidated and worn out conditions of the factories had not only aggravated the problem but also intensified the pollutional nature of their effluents. (*National Herald*, November 18, 1975).

WEST BENGAL

The gift of the Ganga

UT for the small montane region in the far north and the rather low plateau along the western border, West Bengal is essentially a flat alluvial plain formed by the Ganga delta. In the north, the plains extend into the islands formed by mud and silt brought down by the Ganga and covered by dense vegetation. Almost the entire State lies under the high rainfall zone.

Criss-crossed by the Ganga, the Damodar and their several tributaries, the State is also called a land of rivers. These water arteries provide a major source of irrigation, inland water transport and fishery. Despite bountiful rivers and rainfall, some parts of the State suffer from scarcity conditions for want of timely precipitation. By and large, the State has ample water resources. Soils are also generally good. These two taken together have provided the basis for the legendary *Sonar Bangla* (the Golden Bengal). If the real situation is not exactly golden, the reasons lie elsewhere.

Rainfall: West Bengal receives an average annual rainfall of 174 cm (69 inches). More than 70 per cent of the precipitation is received during the monsoon months of June and September. Expectedly, there are wide regional variations. While the Himalayan region receives the heaviest rainfall, ranging between 250 cm and over 500 cm (98 and over 197 inches), the districts in the plains receive on an average 113 cm to 188 cm (44 to 74 inches) of rainfall. Even among the districts in the plains, the distribution of rainfall is uneven and erratic. It is these wide variations and the heavy seasonal concentration of rainfall which cause both droughts and floods.

Rivers: The State is predominantly a land of rivers and aptly described as the "Gift of the Ganga." Except the three northern districts, the State is, by and large, a flat plain criss-crossed by numerous rivers. The principal rivers of West Bengal can be broadly grouped into four systems: (1) The northern system consists of a number of swift flowing perennial rivers like the Tista, the Torsa, the Jaldhaka, the Mahananda and the Rangit and their tributaries flowing in the districts of Jalpaiguri and Darjeeling; (2) the central system is dominated by the Bhagirathi-Hooghly, an arm of the Ganga. The Bhagirathi

separates the three northern districts, viz, Cooch Behar, Darjeeling and Jalpaiguri and the adjoining plain of West Dinajpur and Malda districts from the rest of the State. The vast alluvial plain in the south is mainly the creation of the Bhagirathi and its tributaries; (3) the western system consists of the Mayurakshi, the Ajoy, the Damodar, the Kangsabati and the Dwarka rivers; and (4) the fourth system consists of the tidal and estuarine rivers of Sunderbans. Apart from major rivers like the Hooghly, the Ichamati, the Kalinadi and the Rajmangal, there are several channels like the Saptamukhi, the Thakuran, the Malta, and the Gosaba passing through the area.

The Ganga, the Tista, the Torsa, the Jaldhaka, the Rangit and some of their tributaries are the only perennial rivers in the State. Other rivers being all rain-fed, the highest flow in them is during the monsoon months which dwindles in the post-monsoon months. For example, the flow in the Mayurakshi river varies from 908 m cu m during the monsoon to 31 m cu m during the post-monsoon months. The seasonal and annual flows recorded at certain specific points in some of the rivers of the State are shown in Table 1.

Inland waterways: Unlike many

other States, the rivers here are good for navigation. The State accounts for about one-sixth of the total navigable waterways in India (comprising rivers and canals) and ranks second only to Uttar Pradesh. By and large, the Ganga forms the backbone of these waterways. The recently commissioned Farakka Barrage has facilitated round-the-year navigation through Calcutta port. Given

Table 1 : Seasonal and annual flows of rivers of West Bengal

River	Total flow (m. cu. m)	Percentage of yield		
		June-Sept.	Oct.-Dec.	Jan.-May
Mayurakshi	1,032	88	9	3
Kangsabati	1,653	82	17	1
Damodar	8,102	67	23	10
Tista	17,658	63	20	17
Torsa	8,692	70	16	14

SOURCE: Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. II, p. 422

time and proper planning, these rivers can very well meet much of the growing transport need of the State through waterways.

Irrigation: Considering the river water resources, expectedly, canals are the most important source and are the very backbone of the irrigation network in the State. Nearly two-thirds of the total net irrigated area receives irrigation through canals. Tanks account for about one-fifth of the net irrigated area. Irrigation through wells is negligible as they are usually not used for agricultural purposes. However, more recently



Small irrigation, Bankura.

RIVER SYSTEM OF WEST BENGAL



Table 2 : Major and medium irrigation projects: August-end 1975

(Lakh hectares)

Project	Location of project		Ultimate irrigation potential in West Bengal		
	River	District	Completed	Under execution	Total
Tista Barrage	Tista	West Dinajpur	—	10.7	10.7
Kangsabati	Kangsabati	Bankura	2.4	1.6	4.0
DVC: Irrigation	Damodar	Burdwan	3.5	0.1	3.6
Mayurakshi	Mayurakshi	Birbhum	2.4	0.1	2.5
*Medium projects :	Completed	3	—	—	0.3
	Under execution	3			

*Data relate to March-end 1973

SOURCE : Ministry of Irrigation and Power, Annual Reports and other documents

he emphasis has shifted to the development of lift irrigation. The number of deep tubewells, shallow tubewells and river-lifts registered more than a five-fold rise from 13,508 in 1968-69 to 68,517 at the end of 1973-74. With a view to increasing minor irrigation facilities, the State government has set up the Minor Irrigation Corporation.

More than one-fourth of the State's net sown area received irrigation in 1970-71. The entire net sown area as well as the net irrigated area fall under the high rainfall region (above 115 cm or 45 inches) and thus have a reasonably assured supply of water. According to the Irrigation Commission (1972), West Bengal has an ultimate irrigation potential (surface as well as groundwater) of 43 lakh hectares. In other words, when fully utilised, about four-fifths of the net sown area (1970-71) would come under irrigation. However, of the total ultimate potential, only a little over one-third was harnessed in 1970-71.

Major and medium irrigation projects are shown in Table 2. Besides, the foundation stone for the Rs 70-crore

Table 3 : Groundwater resources of West Bengal

(Million acre feet)

1.	Total groundwater resources (a)	23.0
2.	Losses through evapo-transpiration and sub-surface run-off at 30 per cent	6.9
3.	Net groundwater recharge (1 minus 2)	16.1
4.	Annual draft by the end of 1967-68	0.36
5.	Net groundwater recharge available for further groundwater development (3 minus 4)	15.7

NOTE : (a) Total resources are made up of contribution of rainfall to groundwater recharge and possible recharge due to canal infiltration.

SOURCES: Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. I, p. 55

Mahananda Barrage constituting the first phase of the Tista Barrage was recently laid at Dhumdangi in West

Dinajpur district. Another new project formulated by the State Government is the Subarnarekha project.

At the end of 1974-75, irrigation potential of 8.46 lakh hectares was created through the execution of major and medium irrigation projects, out of which about 97 per cent was utilised. Availability of irrigation among the districts is extremely uneven, ranging from 73 per cent of the cultivated area in Birbhum to a bare three per cent in Nadia. There is an almost total absence of double cropping under irrigated areas.

Groundwater resources: According to the Irrigation Commission (1972), the position of groundwater resources in the State is as presented in Table 3. As can be seen from the table, the net

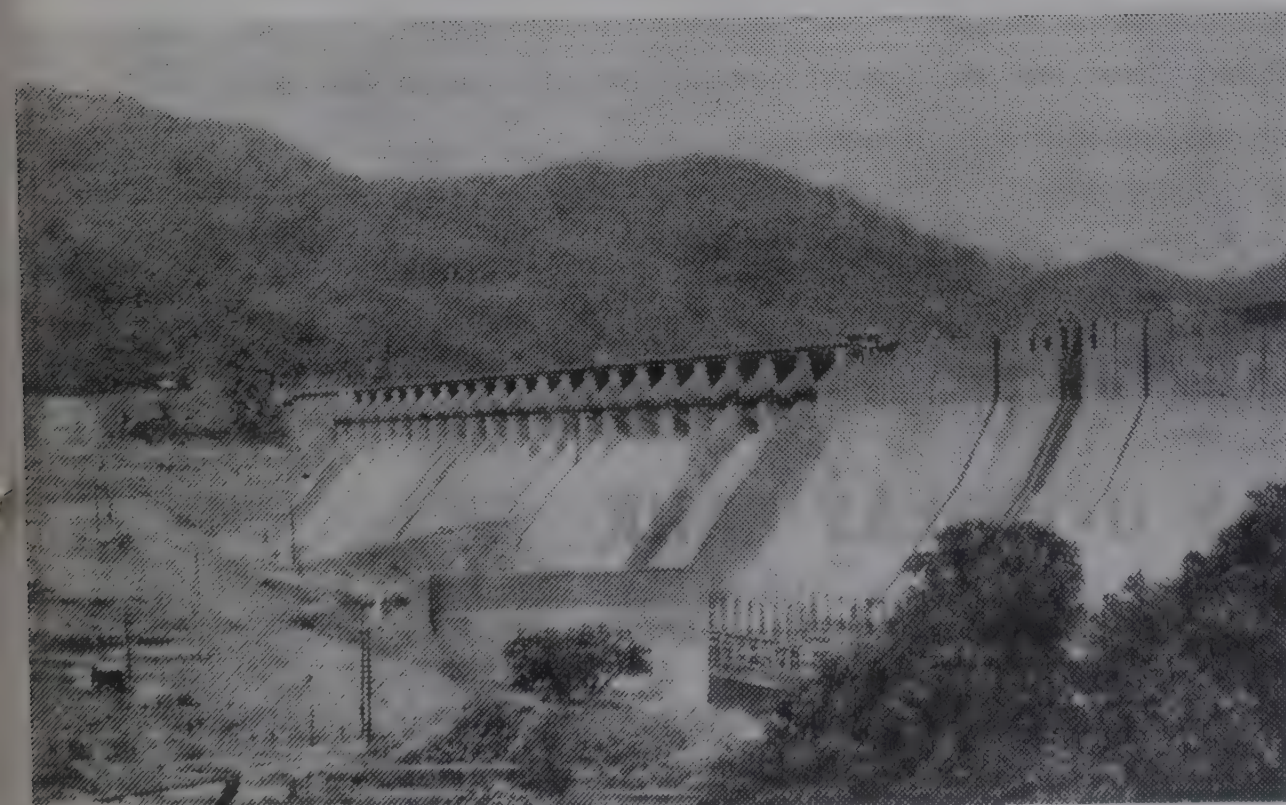
Table 4: District-wise variation of groundwater level

District	Static water level (feet)
Bankura	28 to 45
Burdwan	15 to 37
Cooch Behar	N.A.
Howrah	5 to 28
Jalpaiguri	14 to 25
Malda	10 to 40
Midnapore	4 to 40
Murshidabad	11 to 20
24-Parganas	
(a) North	10 to 22
(b) South	2 to 10
West Dinajpur	10 to 30

groundwater recharge is 16.1 million acre feet, of which 15.7 million acre feet is available for further groundwater development. Further, the survey conducted by the Geological Survey of India has revealed that shallow tubewells can be successfully sunk in certain areas like the districts of Cooch Behar, Jalpaiguri, Darjeeling, parts of West Dinajpur and Malda and areas to the north of the river Ganga.

The data regarding district-wise average levels of groundwater, based on the test boring carried out by the State Groundwater Board in different places in the districts, as furnished by our Calcutta correspondent, are presented in Table 4. The groundwater level varies from 2 to 10 feet in South 24-Parganas district to 28 to 45 feet in Bankura district.

Drought-affected areas: Drought in the State is more often caused by want of adequate and timely rainfall rather than by total failure of rains. The Irrigation Commission (1972) has not identified any specific areas as drought-prone areas in the State. However, according to the State Govern-



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ent, drought-affected areas are spread over the districts of Purulia, Bankura, Burdwan, Midnapore, Birbhum, Malda and West Dinajpur. Most of these areas are undulating and hilly, their soil being composed of sandy loam and laterite gravel with a very low moisture retention capacity.

According to official reports, more than 14 lakh people were affected by drought during 1974-75. The worst affected districts were Bankura, Cooch Behar, Midnapore, Murshidabad, Purulia and West Dinajpur.

Floods: Heavy silting and reduction in drainage capacity have increased the flood potential in the State. Large-scale deforestation in catchment areas in the Chotanagpur hills is largely responsible for the floods. In the pre-Independence period, the river Damodar was rightly called "the Sorrow of West Bengal", because of its devastating floods and frequent changes in its course. Thanks to the efforts of the Damodar Valley Corporation which constructed dams across the river in Bihar, the problem of floods in this river was substantially mitigated. During the 1975 monsoon, floods in the Tista and the Jaldhaka rivers had severely affected the districts of Jalpaiguri and Murshidabad.

Drinking water supply: According to the data collected by our Calcutta correspondent on drinking water facilities in rural areas, of the total number of 70,004 villages and hamlets, 8,940 covering more than one-tenth of the State's rural population do not have drinking water facilities (Table 5).

According to a State Government press note, the Government of West Bengal has sanctioned an interim Rural Water Supply Programme for the year 1975-76. The programme includes the construction and re-sinking of 1,635 water sources—tubewells and wells at the rate of five water sources per Development Block—at a total cost of about Rs 49 lakhs (*Amrita Bazar Patrika*, July 6, 1975).

As regards urban areas, nearly two-fifths of the total number of towns have either partial or full water supply facilities. (Dave J.M., "The Progress of Community Water Supply in India", *Souvenir of United Nations Seminar on Water Resources Administration*, January 1973). It is reported that to improve the water supply to Calcutta, four million acre feet of groundwater can be made available if 2,400 one-cusec capa-

Table 5 : Villages and hamlets without adequate drinking water facilities

District	Total number of villages and hamlets	Population of villages and hamlets of the district ('000)	Villages and hamlets without drinking water facilities		
			Number	Population ('000)	As per cent of rural population of the district
Bankura	6,098	1,879	748	243	13
Birbhum	3,925	1,651	85	140	8
Burdwan	6,624	3,024	331	194	6
Cooch Behar	2,015	1,318	257	103	8
Darjeeling	926	151	276	42	28
(Siliguri Sub-Division)					
Hooghly	2,998	2,112	23	97	5
Howrah	1,964	1,404	72	170	12
Jalpaiguri	1,804	1,582	209	83	5
Malda	4,468	1,545	417	185	12
Midnapore	14,824	5,079	2,679	972	19
Murshidabad	3,447	2,692	146	59	2
Nadia	1,435	1,812	60	136	8
Purulia	4,052	1,471	927	262	18
24-Parganas	8,299	5,479	1,310	457	8
West Dinajpur	7,125	1,686	1,400	209	12
Total	70,004	31,621	8,940	3,352	11

city deep tubewells or 48,000 shallow tubewells are dug (*The Economic Times*, July 16, 1973).

Pollution: The problem of water pollution is mainly confined to the industrialised regions of Durgapur-Asansol and Calcutta and their peripheries. According to the Survey made by the National Environmental Engineering Research Institute, major industrial units in the Durgapur-Asansol belt discharge a total 1.59 lakh cubic metres of effluents into the Damodar river—the main source of water for this region. The quantum of discharge is equivalent to sewerage produced by a city with a population of about 10 lakhs and contains toxic compounds like cyanides, phenols and ammonia which make the water unfit for drinking and fish farming (*The Times of India*, July 2, 1975).

In regard to liquid pollutants, Mr Sivadas Banerjee has recently reported (*The Times of India* of December 17, 1975) that it has been found on investigation that industries and municipalities on both banks of the Hooghly between Durgapur and Barakar pour polluted water into the rivers at the rate of 2,560 gallons a second. This water has chemical pollutants, organic matter, bacteria, suspended particles and a large quantity of waste water with practically no oxygen. This not only makes the water unsuitable for irrigation and lowers its potability, but also keeps

the biological oxygen demand of the water too low for fishes. A solution to this problem lies in the installation of water treatment recovery units—one in each large industrial undertaking and one in each sector on a co-operative basis for small industries and municipalities. The problem is much more serious in the case of the Damodar, which has a controlled and often limited water discharge, than in the case of the Hooghly; but even in the case of the latter, bathing has already become too risky.

Mr B. K. Bhaumik, Senior Chemist of the Damodar Valley Corporation, as quoted by Mr Banerjee, says that "conventional treatment by alum and lime for clarification of such polluted water is not satisfactory" and that chlorination must precede the clarification process. "But the presence of substances toxic to the human system such as phenolic compounds, cyanide and pathogenic micro-organisms cannot be avoided in clarified drinking water processed from the Damodar water, because chlorination as also clarification are not always effective in their removal. If we want to put a stop to health hazards in this valley, we must see that the water of this river does not get polluted with toxic substances." These observations also hold good for the Hooghly water which is supplied for drinking to millions of people after treatment of varying standards.

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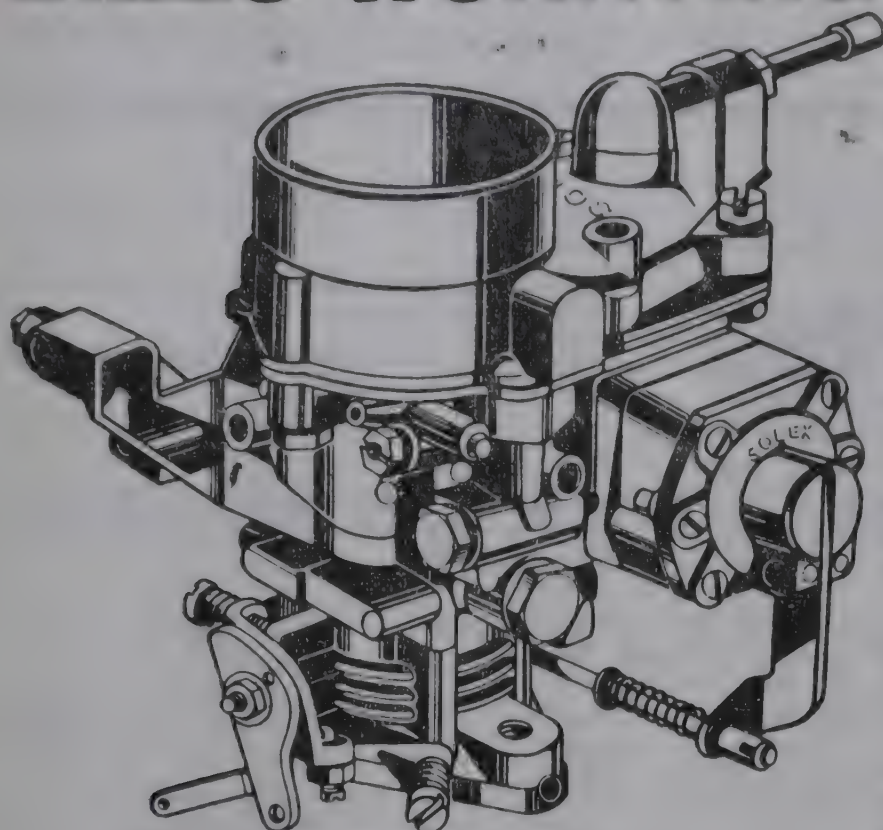
General

- ron, Wiener, *Development and Management of Water Supplies Under Conditions of Scarcity of Resources*, Tel Aviv, April 1964.
- Advisory Committee on Technology Innovation, *More Water for Arid Lands, Promising Technologies and Research Opportunities*, National Academy of Sciences, Washington, 1974.
- orley, Richard, J. (Ed.), *Introduction to Geographical Hydrology*, Methuen & Co. Ltd., London, 1969.
- orley, Richard, J. (Ed.), *Introduction to Fluvial Processes*, Methuen & Co. Ltd., London, 1969.
- orley, Richard, J. (Ed.), *Introduction to Physical Hydrology*, Methuen & Co. Ltd., London, 1969.
- ark, Colin, *The Economics of Irrigation*, Second Edition, Oxford, 1970.
- avis, Kenneth S. and Day, A. John, *Water: The Mirror of Science*, Vakils, Feffer and Simons Private Ltd., Bombay, 1968.
- Department of Economic and Social Affairs, *Proceedings of the International Seminar on the Economic Application of Water Desalination*, September 22-October 1965, United Nations, New York, 1967.
- Economic Commission for Asia and the Far East, *Planning Water Resources Development*, Water Resources, Series No. 37, United Nations Office of Technical Co-operation, United Nations, New York, August 1969.
- A Compendium of Major International Rivers in the Ecafe Region*, Water Resources, Series No. 29, New York.
- Glossary of Hydrologic Terms Used in Asia and the Far East*, Flood Control Series No. 10, New York.
- Manual of Standards and Criteria for Planning Water Resource Projects*, Water Resources, Series No. 26, New York.
- Methods and Techniques of Ground Water, Investigation and Development*, Water Resources, Series No. 33, New York.
- Multiple-Purpose River Basin Development, Part I, Manual of River Basin Planning*, Flood Control, Series No. 7, New York.
- Multiple-Purpose River Basin Development, Part 2B, Water Resources Development in Burma, India and Pakistan*, Flood Control, Series No. 11, New York.
- Standards for Methods and Records of Hydrologic Measurement*, Flood Control, Series No. 6, New York.
- The Use and Interpretation of Hydrologic Data*, Water Resources, Series No. 33, New York.
- Hills, E. S. (Ed.), *Arid Lands — A Geographical Appraisal*, Methuen & Co. Ltd. and Unesco, London, 1969.
- Hill, Ernestine, *Water Into Gold*, Walkabout Pocketbooks, 1969.
- International Bank for Reconstruction and Development, International Development Association, Economic Department, *Economic Aspects of Water Utilization in Irrigation Projects*, January 1965.
- Leopold Luna B., Davis Kenneth S. and et al., *Water*, Time-Life International (Nederland) N.V., 1968.
- Loughlin, J. C., *Cost-Sharing for Federal Water Resources Programmes with Emphasis on Flood Protection*, Water Resources Research, March, 1970.
- Lvovich, M. I., *The World's Water, Today and Tomorrow*, Mir Publishers, Moscow, 1973.
- Michael, A. M. and Ojha, T. P., *Principles of Agricultural Engineering: Machinery, Power and Building*, Vol. I, Jain Brothers, New Delhi, 1966.
- *Principles of Agricultural Engineering: Surveying, Irrigation, Drainage and Soil Conservation*, Vol. II, New Delhi, 1966.
- Michael, A. M., Shri Mohan and Swaminathan, K. R., *Design and Evaluation of Irrigation Methods*, Water Technology Centre, Indian Agricultural Research Institute, New Delhi, 1972.
- Ministry of Agriculture, Fisheries and Food, *Water for Irrigation, Supply and Storage*, Bulletin No. 202, London, 1967.
- Paliwal, K. V., *Irrigation with Saline Water*, Water Technology Centre, Indian Agricultural Research Institute, New Delhi, 1972.
- Pillsbury, Arthur F. and Degan, Ariosto, *Sprinkler Irrigation*, Food and Agriculture Organisation of the United Nations, Rome, 1972.
- Prushansky Yehoshua, *Water Development*, *Israel Today*, No. 11, Israel Digest, Jerusalem, December 1964.
- Ray, Popkin, *Desalination: Water For World's Future*, Frederick A. Praeger Publishers, New York.
- Sally, H. L., *Irrigation Planning for Intensive Cultivation*, Asia Publishing House, Bombay, 1968.
- Sara Grossman-Pines, Jochanan Bonne and Zvi Grinwala (Ed), *Water in Israel, 1962-1971*, Part A and Part B, Ministry of Agriculture, Water Commission, Water Allocation Department, Tel-Aviv, March 1973.
- Siline-Bekchourine A., *Hydrogeology of Irrigated Lands*, Moscow.
- Slatyer, R. O., and Perry, R. A. (Ed), *Arid Lands of Australia*, Australian National University, Canberra, 1969.
- Smith, L. P. *Weather and Food*, World Meteorological Organization, Geneva, 1962.
- Sutton, O. G., *Understanding Weather*, Sunninghill, Berks, December 1969.
- United States Department of Agriculture, *Water, The Yearbook of Agriculture 1955*, Oxford & IBH Publishing Co., Bombay, 1969.
- USDA Tech. Release No. 21 (Rev. 1), *Irrigation Water Requirements*, February 1967.
- U.S. Government, *Report on Land and Water Development in the Indus Plain*, 1964.
- Weitz, *Economics of Water Supply in the National Economy*, Rehovoth, Israel, 1964.
- World Congress on Water Resources, *Water for Human Needs, Proceedings of the Second World Congress on Water Resources, Energy and Food*, Vol. I, New Delhi, 1975.
- *Health and Planning*, Vol. II, New Delhi, 1975.
- *Development and Meteorology*, Vol. III, New Delhi, 1975.
- *Management and Education*, Vol. IV, New Delhi, 1975.
- *Technology and Ecology*, Vol. V, New Delhi, 1975.
- Yaron, *Economic Criteria for Water Resource Development*, Hebrew University of Jerusalem, 1966.

India

- Ahuja, P. R., *Hydrology, Development and Utilization of Water Resources of India*, Ministry of Irrigation and Power, New Delhi, 1966.
- Ansari, Nasim, *Economics of Irrigation Rates, A Study in Punjab and Uttar Pradesh*, Asia Publishing House, Bombay, 1968.
- Banerji, S. and Lal, V. B., *Integrated Planning for Water Resources in India*, 1971.
- Bhatia, B. M., *Famines in India, 1860-1965*, Asia Publishing House, Bombay, 1968.
- Central Board of Irrigation and Power, 40th Annual Board Session, *Symposium on Irrigation Water Management*, New Delhi, 1967.
- Central Board of Irrigation and Power, *Symposium on Management Problems in Irrigation and Power Systems*, Vol. I and II, Publication No. 122, New Delhi, January 1974.
- *Seminar on National Water and Power Grids Vol. I, Technical Papers on National Water Grid*, New Delhi, December 1972.
- *Administration and Financing of Irrigation Works in India*, New Delhi, 1965.
- *Development of Irrigation in India*, New Delhi, 1965.
- Chatterji, G. C., *Recent Advances in Groundwater Development*, Mining, Geological and Metallurgical Institute of India, Calcutta.
- Dagli, Vadilal (Ed), *A Regional Profile of Indian Agriculture*, Vora & Co., Bombay, 1974.
- Dakshinamurti, C., Michael, A. M. and Shri Mohan, *Water Resources of India and Their Utilisation in Agriculture*, Water Technology Centre, Indian Agricultural Research Institute, New Delhi, 1973.
- Das, P. K. (Dr.), *The Monsoons*, National Book Trust, New Delhi, 1968.
- Dastane, N. G., *A Practical Manual for Water Use Research*, Navbharat Prakashans, Poona, 1967.
- Dey, A. K., *Geology of India*, National Book Trust, New Delhi.
- Economic Commission for Asia and the Far East, *A Case Study of the Damodar Valley Corporation and its Projects*, Flood Control Series No. 16, United Nations Office of the Technical Co-operation, United Nations, New York.
- Frenkiel J., *Arid Zone Research - XXVII Evaporation Reduction*, Unesco, Paris, 1965.
- Gokhale Institute Publication, No. 17, *Economic Effects of Irrigation*, Poona, 1948.

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Government of India, *Report on Inter-Regional Seminar on Water Resources Administration*, January-February 1973, New Delhi, 1973.

Government of India, Ministry of Irrigation and Power, Central Water and Power Commission, *Central Water and Power Research Station*, Poona, New Delhi.

Fifty Years of CWPRS, 1916-1966, Golden Jubilee Souvenir, New Delhi, 1965.

India: Irrigation and Power Projects (Five Year Plan), New Delhi, 1970.

Report of the Ministers' Committee on Under-Utilisation of Created Irrigation Potential, New Delhi, 1973.

Report of the Narmada Water Resources Development Committee, New Delhi, September, 1965.

Report of the Irrigation Commission 1972, Vol. I, Vol. II, Vol. III and Vol. IV, New Delhi, 1972.

River Valley Projects in India, New Delhi, 1965.

Report of the Krishna Godavari Commission, New Delhi, July 1962.

Government of India, Ministry of Food, Agriculture, Directorate of Economics and Statistics, *Indian Agriculture in Brief* (Various issues).

Government of India, Ministry of Food and Agriculture and Community Development and Co-operation (Department of Agriculture), *Report of the Working Group for Formulation of Fourth Five Year Plan Proposals on Minor Irrigation and Rural Electrification*, New Delhi, 1968.

Government of India, Planning Commission, *Study on Soil Conservation in the Catchment Areas above Dams in River Valley Projects, Part I*, New Delhi, 1966.

Study on Survey and Reclamation of Ravines in India, New Delhi, 1966.

Government of India, Planning Commission, Committee on Natural Resources, *Study of Waste Lands Including Saline, Alkali and Water-logged Lands and Their Reclamation Measures*, New Delhi, 1963.

Government of India, Planning Commission, Programme Evaluation Organisation, *Evaluation of Major Irrigation Projects, Some Case Studies*, New Delhi, August 1966.

Study of the Problems of Minor Irrigation, New Delhi, 1961.

Gulhati, N. D., *Development of Inter-State Rivers Law and Practices in India*, Allied Publishers, Bombay, 1972.

Indian Agricultural Research Institute, *Handbook of Farm Irrigation Structures*, Research Bulletins, No. 3, New Delhi, 1970.

A New Technology for Dry Land Farming, New Delhi, 1970.

Indian Council of Agricultural Research, *Soil and Water Research in India in Retrospect and Prospect*, New Delhi, January 1971.

Symposium on Soil and Water Management, Held at Hissar, March 11-13, 1969, New Delhi, February 1972.

International Symposium on Development of Ground Water Resources, Vols. I to IV, College of Engineering, Guindy, Madras, November 1973.

Indian Statistical Institute Planning Unit, *Price Policy for Irrigation Undertakings: A Preliminary Study*, August 1961.

Jhaveri, B. C., *Memorandum on Multi-Purpose Development of Narmada Waters on Integrated Basis and Their Equitable Utilization*, Surat, January 1973.

Joshi, Rao Bahadur, N. S. and Dhekney, B. R., *Irrigation and Agriculture in the First Five*

Year Plan: An Appraisal, Vol. I, Deccan Book Stall, Poona, 1954.

Journal of Central Board of Irrigation and Power, *Irrigation and Power*, Vol. 31, No. I, January 1974.

Koteswaran, P., *Rainfall Atlas of India*, Indian Meteorological Department, New Delhi, 1971.

Kulkarni, D. G., *People and Irriculture*, Orient Longmans Ltd, New Delhi, January 1970.

Lahiri, Abhijit, *A Long-Range Perspective for India, Water Resources: 2000 A.D.*, Operations Research Group, Baroda, 1975.

Lakshminarayana, V. and Revelle, Roger, *The Ganges Water Machine*, American Association for the Advancement of Science, Washington, May 1975.

Lal Deepak, *Wells and Welfare*, Development Centre of the Organisation for Economic Co-operation and Development, Paris, 1972.

Law, B. C. (Dr.), *Monsoons and Rivers of India*, National Committee for Geography, Calcutta, 1968.

Michael, A. M., Reeser, R. M. and Knierim, G. C., *How To Improve Irrigation Farming in India*, Extension Bulletin No. 2, University of Udaipur, College of Agriculture, Jobner, March 1975.

Ministry of Agriculture, Department of Agriculture, Water Management Division, *Handbook on Irrigation Water Management*, New Delhi, September 1971.

— *Guide for Estimating Irrigation Water Requirements*, Technical Series No. 2, New Delhi, July 1971.

National Council of Applied Economic Research, *Criteria for Fixation of Water Rates and Selection of Irrigation Projects*, Asia Publishing House, Bombay, 1959.

Parliament of India, Rajya Sabha, *Joint Committee on the Prevention of Water Pollution Bill, Evidence*, Vol. II, Rajya Sabha Secretariat, New Delhi, November 1972.

Patel, S. M. and Patel, K. V., *Some Techno-Economic Aspects of Lift Irrigation System*, Indian Institute of Management, Ahmedabad, 1969.

Gadgil, D. R., *Evaluation of the Benefits of Irrigation Projects*, Planning Commission Research Programme Committee.

Ramdas, L. A., *Crops and Weather in India*, Pub. I.C.R.A. No. 73, New Delhi, 1960.

Randhwa, M. S. and Prem Nath, *Farmers of India*, Vol. I, (Punjab, Himachal Pradesh, Jammu and Kashmir), Indian Council of Agricultural Research, New Delhi, 1959.

Randhawa, M. S., Vaidya, Suresh, Sivaraman, M. S. and Naidu, I. J., *Farmers of India*, Vol. II, (Madras, Andhra Pradesh, Mysore, Kerala), Indian Council of Agricultural Research, New Delhi, 1959.

Randhawa, M. S., Mitra, Asok and Mehta, Gisela, *Farmers of India*, Vol. III, (Assam, Orissa, West Bengal, Andaman and Nicobar, Manipur, NEFA, Tripura), Indian Council of Agricultural Research, New Delhi, 1964.

Randhawa, M. S. and others, *Farmers of India*, Vol. IV, (Madhya Pradesh, Rajasthan, Gujarat, Maharashtra), Indian Council of Agricultural Research, New Delhi, 1968.

Rao, K. L., *Planning and Development of Water Resources in India*, Ministry of Irrigation and Power, New Delhi, 1972.

Rao, K. L., *India's Water Wealth*, Orient Longman, New Delhi, 1975.

Sally, H. L., *Lining of Earthen Irrigation Channels*, Asia Publishing House, Bombay, 1965.

Singh, R. L., *India: A Regional Geography*, National Geographical Society of India, Varanasi, January 1971.

Souri Rajan, S., *Reverse Osmosis*, Logos Press Ltd., London.

Sovani and Rath, *Economics of a Multiple Purpose River Dam*, Gokhale Institute Publication, Poona.

The Tamil Nadu Agricultural University, The Department of Agriculture, Tamil Nadu and The USAID/APP, Coimbatore, *Ground Water and Water Wells. The Madras Agricultural Journal*, Vol. 59, No. 2, Agricultural College Research Institute, Coimbatore, November 1971. (Special Number).

Vohra, B.B., *Land and Water Management Problems in India*, Training Division, Department of Personnel and Administrative Reforms, Cabinet Secretariat, New Delhi, March 1975.

Journals

Agricultural Finance and Development Corporation, *Financing Agriculture*, Bombay.

Indian Council of Agricultural Research, *Indian Farming*, New Delhi.

Indian Water Works Association, *Journal of Indian Water Works Association*, Bombay.

Government of India, Ministry of Irrigation and Power, *Bhagirath*, Director, Publications Division, New Delhi.

Government of India, Ministry of Agriculture and Irrigation, Directorate of Economics and Statistics, *Agricultural Situation in India*, New Delhi.

Government of India, Ministry of Agriculture and Irrigation, Directorate of Extension, The Farm Information Unit, *Intensive Agriculture*, New Delhi.

Soil Conservation Society of America, *Soil and Water Conservation*, Ankeny, Iowa.

The Arid Zone Research Association of India, *Annals of Arid Zone*, Jodhpur.

Regional

Andhra Pradesh

Government of Andhra Pradesh, Director of Information and Public Relations, *Andhra Pradesh*, Hyderabad, 1969.

Government of Andhra Pradesh, General Administration Department, *State Administration Report 1968-69*, Hyderabad.

Government of Andhra Pradesh, Planning and Panchayati Raj Department, *Fourth Five Year Plan, Andhra Pradesh—A Draft Outline*, 1968.

Government of Andhra Pradesh, Public Works Department, *Irrigation Potential of Andhra Pradesh*, Hyderabad.

Government of Andhra Pradesh, *Budget Speech, 1975-76*, 1975.

National Council of Applied Economic Research, *Techno-Economic Survey of Andhra Pradesh*, New Delhi, 1962.

Superintendent of Census Operations, Andhra Pradesh, *Census of India 1961*, Vol. II, *Andhra Pradesh. Part IX, State Atlas*, Hyderabad, 1966.

Assam, Meghalaya and Mizoram

Barkataki, S., *Assam*, National Book Trust, New Delhi, 1969.

Barthakur, P.B., *Assam*, Government of India, Ministry of Information and Broadcasting, Publications Division, New Delhi, 1974.

Das, H.P., *Geography of Assam*, National Book Trust, New Delhi, 1970.

Gauhati University, *Assam Economic Review*, Gauhati, 1971.

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ami, P.C., *The Economic Development of Assam*, Asia Publishing House, Bombay, 1963.

Government of Assam, Department of Economics and Statistics, *Assam Through The First Five Year Plans*, Shillong, 1970.

Economic Survey : Assam, (Various issues).

Government of Assam, Planning and Development Department, *Fourth Five Year Plan of Assam, A Draft Outline*, Shillong, 1968.

Government of Assam, *Budget Speech, 1975-76*, 1975.

Government of Meghalaya, *Budget Speech, 1975-76*, 1975.

National Council of Applied Economic Research, *Techno-Economic Survey of Assam*, Delhi, 1972.

Ar

Sharma, R., and Choudhary, K. L., *Short and Long Term Programme for Development of Water Resources, Resources for Augmenting Irrigation Supplies with Particular Reference to Bihar*, (Symposium on Irrigation Water Management, 40th Annual Board Session), Central Board of Irrigation and Power.

Government of Bihar, Planning Department, *Approach to the Fifth Five Year Plan (1974-79)*, Patna, September, 1972.

Government of Bihar, *Budget Speech, 1975-76*, 1975.

National Council of Applied Economic Research, *Techno-Economic Survey of Bihar*, New Delhi, 1960.

Gujarat

Patel, Narhari K., *Gujarat*, Government of India, Ministry of Information and Broadcasting, Publications Division, New Delhi, 1974.

Desai, I. P., *Water Facilities for the Untouchables in Rural Gujarat*, Indian Council of Social Science Research, New Delhi, March 1973.

Shankar, K. R., *Geography of Gujarat*, National Book Trust, New Delhi, 1970.

Federation of Gujarat Mills and Industries, *Proceedings of Seminar on Economic Management of Ground Water Resources of Gujarat*, Baroda, March 1973.

Government of Bombay, Report of the Fact Finding Committee : *Survey of Scarcity Areas in Bombay, Part Two—Gujarat*, Bombay, 1960.

Government of Gujarat, Bureau of Economics and Statistics, *Co-operative Lift Irrigation Schemes : An Evaluation*, Ahmedabad, 1966.

Socio-economic Review, Gujarat State, (Various issues).

Government of Gujarat, Directorate of Information, *Gujarat 1971*, Gandhinagar, 1971.

Government of Gujarat, *Budget Speech, 1975-76*, 1975.

Government of Gujarat, General Administration Department (Planning), *Perspective Plan of Gujarat, 1974-84*, Vol. I and Vol. II, Gandhinagar, 1972.

Government of India, *Census Atlas, Census 1961 Reports: Gujarat*, No. IX, New Delhi.

Gujarat State Fertilizers Company Ltd., Marketing and Development Department, *Study on Likely Agricultural Developments of the Command Area of the Kadana Dam*, Fertilizernagar, Baroda, 1970.

Jodha, N. S., and Vyas, V. S., *Conditions of Stability and Growth in Arid Agriculture*,

Agro-economic Research Centre, Vallabh Vidyanagar, 1969.

Kothari, V. N., and Dadi, M. M., *Economic Benefits of Rural Electrification in Gujarat*, M. S. University of Baroda, Baroda, 1975.

Mishra, R. R., *Minor Irrigation works in Gujarat State*, New Delhi, 1963.

National Council of Applied Economic Research, *Techno-Economic Survey of Gujarat*, New Delhi, 1963.

Patel, G. A., and Patel, K. S., *Gujarat State, Agricultural Atlas*, Government of Gujarat, Ahmedabad, 1968.

Patel, S. M., Madappa, P. P., and Desai, B. M., *Management of Lift Irrigation, Report on a Pilot Research Project in Gujarat*, Indian Institute of Management, Ahmedabad, June 1969.

Patel, S. M., and Patel, K. V., *Studies on Economics of Rural Electrification and Lift Irrigation*, Indian Institute of Management, Ahmedabad, 1969.

State Planning Advisory Board, Government of Gujarat, *Report of the Working Group on Water and Air Pollution for a Perspective Plan, 1972-1984*, Ahmedabad, 1971.

Haryana

Government of Haryana, *Budget Speech, 1975-76*, 1975.

Government of Haryana, Director, Public Relations, *Haryana*, (Various issues).

Government of Haryana, Economic and Statistical Organisation, *Statistical Abstract of Haryana*, (Various issues), Chandigarh, 1969.

Government of Haryana, *Haryana-Achievements*, May 1968-January 1971.

— *Budget Speech, 1975-76*, 1975.

Government of Haryana, Planning Department, *Fourth Five Year Plan, 1969-74 Draft Proposals*, Chandigarh, 1968.

— *Economic Survey of Haryana* (Various issues).

— *Irrigation, Flood Control and Power Statistics*, Chandigarh, 1970.

— *Report of the Utilisation of Loans for Minor Irrigation Works in the State*, Chandigarh, 1970.

— *Report of the Working of Government Tubewells in Haryana*, Chandigarh, 1971.

Marketing and Economic Research Bureau, *Economic Impact of Drought in Haryana, A Survey*, New Delhi, 1971.

National Council of Applied Economic Research, *Techno-Economic Survey of Haryana*, New Delhi, 1970.

Singhal, S. B., *Haryana*, Government of India, Ministry of Information and Broadcasting, Publications Division, New Delhi, 1971.

Himachal Pradesh

Government of Himachal Pradesh, *Budget Speech, 1975-76*, 1975.

Government of Himachal Pradesh, Directorate of Economics and Statistics, *Economic Review of Himachal Pradesh*, (Various issues), Simla, 1961.

National Council of Applied Economic Research, *Techno-Economic Survey of Himachal Pradesh*, New Delhi, 1961.

Jammu and Kashmir

Bamzai, P. N. K., *Jammu & Kashmir*, Government of India, Ministry of Information and Broadcasting, Publications Division, New Delhi, 1974.

Government of Jammu and Kashmir, *Budget Speech, 1975-76*, 1975.

Government of Jammu and Kashmir, Department of Information, *Jammu and Kashmir 1968*, New Delhi.

National Council of Applied Economic Research, *Techno-Economic Survey of Jammu and Kashmir*, New Delhi, 1969.

Raina, A. N., *Geography of Jammu and Kashmir*, National Book Trust, New Delhi, 1971.

Karnataka

Geography of Mysore, National Book Trust, New Delhi.

Government of Karnataka, *Budget Speech, 1975-76*, 1975.

Government of Mysore, Bureau of Economics and Statistics, *Mysore — An Economic Review*, (Various issues).

— *Report on the Census of Irrigation Wells in Mysore State 1968-69*, Bangalore, 1970.

Government of Mysore, Department of Statistics, *Report on Rainfall of Mysore State for 1964, Part I and Part II*, Bangalore, 1967.

Government of Mysore, Directorate of Statistics, *Mysore After Irrigation — A Survey of Development of Different Regions*, Bangalore, 1969.

Government of Mysore, Planning Department, *Development of Irrigation in Mysore State (1951-69)*, Bangalore, 1971.

— *Fourth Five Year Plan (1969-74)*, (Policy and Programme), Bangalore, 1970.

National Council of Applied Economic Research, *Techno-Economic Survey of Mysore*, New Delhi, 1965.

— *Coastal Water Ways of Mysore*, New Delhi, 1962.

Ramchandriah, N. S., *Mysore*, National Book Trust, New Delhi.

University of Agricultural Sciences, *Effects of Irrigation on Black Soils in the Tungabhadra Project Area in Mysore State*, Bangalore, 1965.

— *Proceedings of the Seminar on Drought*, Bangalore, 1968.

Kerala

Chaitanya, Krishna, *Kerala*, National Book Trust, New Delhi, 1972.

Government of India, Ministry of Information and Broadcasting, Publications Division, *Kerala*, Delhi, 1968.

Government of Kerala, *Budget Speech, 1975-76*, 1975.

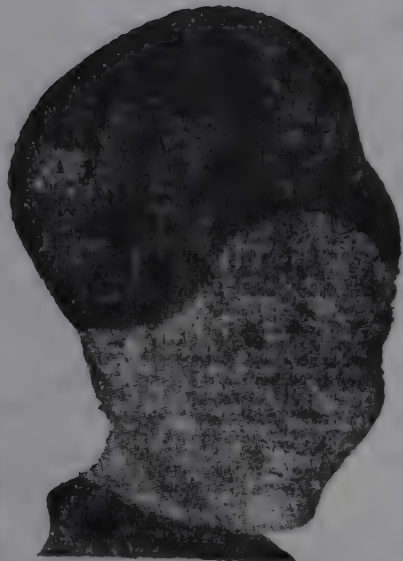
Government of Kerala, State Planning Board, *Economic Review, Kerala* (various issues).

— *Fourth Five Year Plan, 1969-74*, Trivandrum, 1970.

Government of Kerala, Public Works Department, *Irrigation Branch, Water Resources of Kerala: Advance Report*, Trivandrum, 1958.

National Council of Applied Economic Research, *Techno-Economic Survey of Kerala*, New Delhi, 1962.

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Superintendent of Census Operations, Kerala, *Census of India, 1961, Vol. VII, Kerala, Part IX, Census Atlas*, 1967.

Uttar Pradesh

Government of India, Committee on Plan Projects, *Report of the Irrigation and Power Commission on Chambal Project*, New Delhi, 1958.

Government of India, Planning Commission, *Report by the Study Group of Irrigation and Power of the National Planning Council on the Chambal Project*, New Delhi, 1967.

Government of Madhya Pradesh, *Budget Speech, 1975-76*, 1975.

Maharashtra

Chandrasekhar, C. D., *Geography of Maharashtra*, National Book Trust, New Delhi.

Government of Maharashtra, Planning Department, *Draft: Outline of the Fifth Five Year Plan (1974-79)*, Bombay, July 1973.

Government of Maharashtra, *Budget Speech, Part I and II, 1975-76*, 1975.

Karni, D. G., *River Basins of Maharashtra*, Orient Longmans Ltd., New Delhi, January 1970.

Maharashtra Economic Development Council, *Maharashtra—An Economic Review*, Bombay, 1967.

National Council of Applied Economic Research, *Techno-Economic Survey of Maharashtra*, New Delhi, 1963.

Shankar, S. R., *Maharashtra*, Government of India, Ministry of Information and Broadcasting, Publications Division, New Delhi, 1971.

Manipur

Government of Manipur, *Budget Speech, 1975-76*, 1975.

Government of Manipur, Department of Statistics, *Farm Practices*, Imphal, 1972.

National Council of Applied Economic Research, *Techno-Economic Survey of Manipur*, New Delhi, 1961.

Nagaland

Government of Nagaland, *Budget Speech, 1975-76*, 1975.

National Council of Applied Economic Research, *Techno-Economic Survey of Nagaland*, New Delhi, 1968.

Orissa

Chandra, Shreeram, (Dr.), *Orissa*, Government of India, Ministry of Information and Broadcasting, Publications Division, New Delhi, 1974.

Geography of Orissa, National Book Trust, New Delhi.

Government of Orissa, *Budget Speech, 1975-76*, 1975.

Government of India, Planning Commission, *A Report by the Study Group on Irrigation and Power of the National Planning Council on the Hirakud Project*, New Delhi, 1967.

Government of Orissa, Finance Department, *White Paper on the Economic Conditions and the Development Activities in Orissa*, (various issues).

Government of Orissa, Planning and Co-ordination Department, *Draft Fourth Five Year*

Plan (1969-70 - 1973-74) Orissa, Bhuvaneshwar, 1968.

National Council of Applied Economic Research, *Techno-Economic Survey of Orissa*, New Delhi, 1962.

Sovani, N. V., and Rath, Nilakanth, *Economics of a Multiple-Purpose River Dam, Report of an Inquiry into the Economic Benefits of the Hirakud Dam*, Gokhale Institute of Politics and Economics, Poona, 1960.

Superintendent of Census Operations, Orissa, *Census of India, 1961, Vol. XII, Part IX-A, Census Atlas of Orissa*, Delhi, 1965.

Punjab

Economic and Statistical Organisation Government, Punjab, *Report on the Working of State Tubewells in Punjab*, Publication No. 104, Chandigarh, 1971.

Government of Punjab, *Budget Speech, 1975-76*, 1975.

Government of Punjab, Development Commission, *Twenty-five Years of Development in Punjab*, Chandigarh, 1972.

Government of Punjab, Director, Information and Publicity, Tourism and Cultural Affairs, *Five Years of Progress*, Chandigarh, 1971.

Government of Punjab, Economic and Statistical Organisation, *Socio-Economic Review of Punjab 1970-71*, Chandigarh, 1972.

— *Statistical Abstract of Punjab 1968*, Chandigarh, 1969.

Gupta, Sher Singh, *Punjab*, Government of India, Ministry of Information and Broadcasting, Publications Division, New Delhi, 1971.

National Council of Applied Economic Research, *Techno-Economic Survey of Punjab*, New Delhi, 1962.

Raj, K. N., *Some Economic Aspects of Bhakra Nangal Project*, Asia Publishing House, Bombay, 1960.

Rajasthan

Pal, Dharam, *Rajasthan*, National Book Trust, New Delhi, December 1968.

Government of Rajasthan, *Budget Speech, 1975-76*, 1975.

Government of Rajasthan, Directorate of Economics and Statistics, *15 Years of Rajasthan's Economy*, Jaipur, 1969.

Government of Rajasthan, Planning Department, *Approach to the Fifth Five Year Plan*, Jaipur, July 1972.

Mishra, V. C. (Dr.), *Geography of Rajasthan*, National Book Trust, New Delhi, 1967.

National Council of Applied Economic Research, *Techno-Economic Survey of Rajasthan*, New Delhi, 1963.

Rameshwar, S. M., *Resurgent Rajasthan*, Apex Publications, New Delhi, 1962.

Sharma, M. L., *Rajasthan*, Government of India, Ministry of Information and Broadcasting, Publications Division, New Delhi, 1971.

Tamil Nadu

Government of Tamil Nadu, *Budget Speech, 1975-76*, 1975.

Government of Tamil Nadu, Finance Department, *Tamil Nadu, An Economic Appraisal 1971-72*, Madras.

Government of Tamil Nadu, State Planning Commission, *Draft Perspective Plan Frame for Tamil Nadu, 1972-84*, Madras.

National Council of Applied Economic Research, *Economic Atlas of Madras State*, New Delhi, 1962.

— *Techno-Economic Survey of Madras*, New Delhi, 1961.

Government of India, Ministry of Information and Broadcasting, Publications Division, *Tamil Nadu*, New Delhi, 1975.

Tripura

Government of India, *Tripura on the March*, 1968.

Government of Tripura, *Budget Speech, 1975-76*, 1975.

Government of Tripura, Agricultural Information Department, *Progress of Agricultural Since Independence*, (in Bengali), 1972.

National Council of Applied Economic Research, *Techno-Economic Survey of Tripura*, New Delhi, 1961.

Uttar Pradesh

Chaturvedi, J. P., *Uttar Pradesh*, Government of India, Ministry of Information and Broadcasting, Publications Division, New Delhi, 1970.

Committee on Plan Projects, Minor Irrigation Team, *Report on State Tubewells, Uttar Pradesh*, New Delhi, October, 1961.

Government of Uttar Pradesh, *Budget Speech, 1975-76*, 1975.

Government of Uttar Pradesh, Director of Information, *Uttar Pradesh, 1971*, Lucknow, 1972.

Government of Uttar Pradesh, Planning Department, *Fourth Five Year Plan*, Lucknow, 1969.

Misra, Shridhar and Singh, Baljit, *Benefit Cost Analysis of the Sarda Canal System*, Asia Publishing House, Lucknow, 1960.

National Council of Applied Economic Research, *Techno-Economic Survey of Uttar Pradesh*, New Delhi, 1965.

Tiwari, A. R., *Geography of Uttar Pradesh*, National Book Trust, New Delhi, 1970.

West Bengal

Basu, S. K. and Mukherjee, S. B., *Evaluation of Damodar Canals (1959-60), A Study of the Benefits of Irrigation in the Damodar Region*, Asia Publishing House, Bombay, 1962.

Bengal Chamber of Commerce and Industry, *West Bengal—An Analytical Study*, Oxford and IBH Publishing Co., New Delhi, 1971.

Bose, S. C., *Geography of West Bengal*, National Book Trust, New Delhi, 1968.

Government of India, Ministry of Information and Broadcasting, *Northern Hill Districts of West Bengal*, 1972.

Government of India, *Report of the Damodar Valley Corporation Enquiry Committee (1952-53)*, 1953.

Government of West Bengal, *Economic Review*, (various issues).

— *Budget Speech, 1975-76*, 1975.

National Council of Applied Economic Research, *Techno-Economic Survey of West Bengal*, New Delhi, 1962.

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All-India profile

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- 1.2 Monthly data on rainfall in India : Average for 1901 to 1960
- 1.3 Utilisable water potential of rivers in India
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SECTION A

Table 1.1 : Annual rainfall data for selected 50 countries (a)

Serial No.	Country	Average annual rainfall (b)	
		Millimetres	Inches
1	Burma (5)	2998	118.0
2	Malaysia (2)	2627	103.4
3	Philippines (10)	2426	95.5
4	Bangladesh (7)	2377	93.6
5	Indonesia (8)	2206	86.9
6	Taiwan (1)	2100	82.7
7	China (3)	1877	73.9
8	Japan (37)	1843	72.6
9	Brazil (43)	1677	66.0
10	Thailand (11)	1639	64.5
11	India (46)	1614	63.5
12	Switzerland (4)	1555	61.2
13	Sri Lanka (4)	1537	60.5
14	Nepal (NA)	1397	55.0
15	South Korea (4)	1371	54.0
16	Nigeria (10)	1345	53.0
17	Australia (26)	1045	43.5
18	Venezuela (9)	1039	40.9
19	Austria (7)	979	38.5
20	Mexico (10)	938	36.9
21	Yugoslavia (6)	908	35.8
22	UK (10)	897	35.3
23	Colombia (1)	867	34.1
24	South Africa (20)	815	32.1
25	Sweden (10)	554	32.1
26	USA (74)	799	31.5
27	Belgium (1)	785	30.9
28	Netherlands (1)	766	30.2
29	Italy (17)	759	29.9
30	France (18)	753	29.7
31	West Germany (12)	734	28.9
32	East Germany (13)	690	27.2
33	Greece (7)	674	26.5
34	Argentina (45)	657	25.9
35	Turkey (23)	643	25.3
36	Bulgaria (5)	622	24.5
37	Canada (46)	611	24.1
38	Hungary (6)	609	24.0
39	Czechoslovakia (6)	602	23.7
40	Poland (18)	565	22.2
41	Romania (7)	560	22.1
42	Spain (11)	493	19.4
43	USSR (81)	396	15.6
44	Pakistan (15)	348	13.1
45	Algeria (6)	307	12.1
46	Iran (8)	232	9.1
47	Iraq (10)	207	8.2
48	Saudi Arabia (3)	48	1.9
49	Egypt (16)	42	1.7
50	Peru (1)	36	1.4

Notes : (a) Out of 215 countries in the world, the above-listed 50 countries account for 87 per cent of the world population, 95 per cent of the world GNP and 87 per cent of the world exports.

(b) The figures for rainfall represent the average of the average annual normals for the number of stations which appear in brackets, for the standard period 1931-1960, computed by the various national climatological and collected by the World Meteorological Organisation.

SOURCES : 1 World Meteorological Organisation, **Climatological Normals (CLINO) for Climat and Climat Ship Stations for the period 1931-1960** (Geneva, 1971).

2 US Department of Commerce—Weather Bureau, **World Weather Records : 1941-50** (Washington D.C., 1959).

3 Rawat, P.C., **Indo-Nepal Economic Relations** (New Delhi, 1974).

Table 1.2 : Monthly data on rainfall in India : Average 1901 to 1960

Season/month	Mean rainfall		Standard deviation (Cm)	Coefficient of variation (Per cent)
	Cm	Per cent		
Winter				
January	2.0	1.7	1.1	52.6
February	2.1	1.8	1.3	58.5
January and February	4.1	3.5	1.5	35.7
Summer				
March	2.5	2.1	1.1	43.0
April	3.8	3.2	0.9	24.5
May	6.3	5.3	1.6	24.8
March to May	12.7	10.7	2.1	16.8
Monsoon				
June	16.6	14.0	3.5	21.2
July	29.7	25.0	3.8	12.8
August	26.0	21.9	3.7	14.2
September	17.4	14.6	3.9	22.2
June to September	89.7	75.5	7.8	8.7
Post monsoon				
October	7.8	6.6	3.0	38.7
November	3.1	2.6	1.7	54.8
December	1.4	1.2	0.8	6.3
October to December	12.2	10.3	3.6	29.5
Annual	118.7	100.0	9.5	8.0

SOURCE : Dhar, O.N. et al, 'A Study of Mean Monthly and Annual Rainfall of Contiguous Indian Area,' **Vayu Mandal**, April-June, 1974.

Table 1.3 : Utilisable water potential of rivers in India (Million acre feet)

River system	Annual run-off	Utilisable quantity
1. Indus system	64	40
2. Narmada, Tapi (west flowing), Godavari, Krishna, Cauvery (east flowing) and other southern rivers	N.A.	200
3. Other west flowing rivers	200	40
4. Ganga system	400	150
5. Brahmaputra system	310	10
6. Mahanadi and other east flowing rivers	160	100
Total	—	540

SOURCE : Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972**, Vol. I, pp. 45-46 and 57.

All-India profile

Table 1.4 : Irrigation facility in relation to cultivated area : 1910-11 to 1971-72

Year	Net area irrigated by sources (Per cent)						Net irrigated area (Million hectares)	Net irrigated area as per cent of net sown area
	Govern-ment canals	Pri-vate canals	Tanks	Wells	Others	Total		
1910-11 to 1914-15(a)	—	—	—	—	—	—	14.5	17.9
1920-21 to 1924-25	—	—	—	—	—	—	16.0	17.4
1930-31 to 1934-35 ..	—	—	—	—	—	—	17.1	17.6
1940-41 to 1944-45 ..	—	—	—	—	—	—	19.0	19.2
1950-51 ..	34.3	5.5	17.3	28.7	14.2	100.0	20.9	17.6
1951-52 ..	—	—	—	—	—	—	21.0	17.6
1952-53 ..	—	—	—	—	—	—	21.1	17.1
1953-54 ..	—	—	—	—	—	—	21.8	17.2
1954-55 ..	—	—	—	—	—	—	22.0	17.2
1955-56 ..	35.3	6.0	19.4	29.6	9.7	100.0	22.8	17.6
1956-57 ..	—	—	—	—	—	—	22.5	17.2
1957-58 ..	—	—	—	—	—	—	23.2	18.0
1958-59 ..	—	—	—	—	—	—	23.4	17.8
1959-60 ..	—	—	—	—	—	—	24.0	18.1
1960-61 ..	37.2	4.9	18.5	29.6	9.8	100.0	24.7	18.5
1961-62 ..	—	—	—	—	—	—	24.9	18.4
1962-63 ..	—	—	—	—	—	—	25.7	18.9
1963-64 ..	—	—	—	—	—	—	25.9	19.0
1964-65 ..	—	—	—	—	—	—	26.6	19.3
1965-66 ..	37.3	4.3	16.2	32.8	9.4	100.0	26.3	19.3
1966-67 ..	—	—	—	—	—	—	26.9	19.6
1967-68 ..	—	—	—	—	—	—	27.2	19.4
1968-69 ..	—	—	—	—	—	—	29.0	21.1
1969-70 ..	—	—	—	—	—	—	30.4	21.9
1970-71 ..	37.1	2.9	14.5	37.8	7.7	100.0	31.2	22.2
1971-72 ..	—	—	—	—	—	—	31.6	22.7

Note : (a) Data for the period are quinquennnial averages

SOURCES : For 1910-11 to 1944-45, Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972, Vol. I**, p. 70; For 1950-51 to 1954-55, Ministry of Food and Agriculture, **Indian Agricultural Statistics, 1955-56, Volume I (Summary Tables)**, 1959; For 1955-56 to 1964-65, Ministry of Food, Agriculture, Community Development and Co-operation, **Indian Agricultural Statistics, 1964-65, Volume I (Summary Tables)**, July 1969; From 1965-66 to 1971-72, Ministry of Agriculture, **Agricultural Situation in India**, various issues and **Agriculture in Brief**, Thirteenth Edition, March, 1974.

SECTION A

Table 1.5 : Fifty major irrigation projects : Position in July 1975

Project	Location of dam/canal (a)	Ultimate gross irrigation potential (Lakh hectares)		
		Completed	Under execution	Total
Sarda Sahayak ..	Kheri (Uttar Pradesh)	1.3	13.7	15.0
Rajasthan Canal	Bikaner, Ganganagar, Jaisalmer (Rajasthan)	—	12.7	12.7
Gandak	Champaran (Bihar)	4.1	7.4	11.5
Tista	West Dinajpur (West Bengal)	—	10.7	10.7
Nagarjunasagar ..	Nalgonda (Andhra Pradesh)	4.3	3.9	8.2
Bhakra Nangal ..	Hisar (Haryana)	6.8	—	6.8
Mahanadi Delta ..	Cuttack (Orissa)	4.6	2.2	6.8
Rajghat	Jhansi (Uttar Pradesh)	—	6.0	6.0
Bhakra Nangal ..	Ropar, Patiala, Sangrur (Punjab)	5.5	—	5.5
Ramganga	Garhwal (Uttar Pradesh)	2.7	3.0	5.7
Godavari Barrage	East Godavari (Andhra Pradesh)	5.4	—	5.4
Beas	Ropar, Patiala, Sangrur (Punjab)	—	4.8	4.8
Kosi	Saharsa (Bihar)	3.0	1.3	4.3
Upper Krishna ..	Bijapur (Karnataka)	—	4.1	4.1
Kangsabati	Bankura (West Bengal)	2.4	1.6	4.0
DVC Irrigation ..	Burdwan (West Bengal)	3.5	0.1	3.6
Tungabhadra ..	Bellary, Raichur (Karnataka)	3.3	0.2	3.5
Tawa	Hoshangabad (Madhya Pradesh)	2.0	1.3	3.3
Bargi	Jabalpur (Madhya Pradesh)	—	3.3	3.3
Gandak	Gorakhpur (Uttar Pradesh)	2.7	0.4	3.1
Chambal	Mandsaur (Madhya Pradesh)	2.7	0.1	2.8
Mahi	Kheda, Panch Mahals (Gujarat)	1.5	1.2	2.7
Tehri Dam	Tehri-Garhwal (Uttar Pradesh)	—	2.7	2.7
Beas	Hisar (Haryana)	—	2.6	2.6
Hirakud	Sambalpur (Orissa)	2.5	—	2.5
Mayurakshi	Birbhum (West Bengal)	2.4	0.1	2.5
Western Yamuna Canal	Ambala, Karnal, Rohtak (Haryana)	—	2.5	2.5
Bhakra Nangal ..	Ganganagar (Rajasthan)	2.3	—	2.3
Chambal	Kota, Bundi (Rajasthan)	—	2.3	2.3
Pochampad	Nizamabad (Andhra Pradesh)	0.6	1.7	2.3
Kakrapar	Surat (Gujarat)	2.1	0.2	2.3
Malprabha	Belgaum (Karnataka)	0.5	1.6	2.1
Anandpur Barrage	Keonjhar (Orissa)	—	1.8	1.8
Bhima	Poona, Sholapur (Maharashtra)	—	1.7	1.7
Somasila	Nellore (Andhra Pradesh)	—	1.7	1.7
Sone	Rohtas (Bihar)	0.9	0.7	1.6
Ukai	Surat (Gujarat)	0.7	0.9	1.6
Tungabhadra ..	Anantapur, Kurnool, Cuddapah (Andhra Pradesh)	1.1	0.4	1.5
Jayakwadi	Aurangabad (Maharashtra)	0.2	1.2	1.4
Ghatprabha	Belgaum (Karnataka)	1.0	0.2	1.2
K.C. Canal	Kurnool, Cuddapah (Andhra Pradesh)	1.2	—	1.2
Mahanadi Reservoir	Raipur (Madhya Pradesh)	—	1.2	1.2
Matatila	Jhansi (Uttar Pradesh)	1.2	—	1.2
Kallada	Trivandrum (Kerala)	—	1.1	1.1
Krishna	Satara (Maharashtra)	—	1.1	1.1
Bagmati Barrage	Muzaffarpur (Bihar)	—	1.0	1.0
Bhadra	Shimoga (Karnataka)	0.9	0.1	1.0
Parambikulam	Coimbatore/Palghat (Tamil Nadu/Kerala)	0.9	0.1	1.0
Aliyar				
Warna	Sangli (Maharashtra)	—	1.0	1.0
Gurgaon Canal ..	Gurgaon, Mahendragarh/Alwar (Haryana/Rajasthan)	—	0.8	0.8
Total for 50 major projects ..		74.3	106.7	181.0
Other 41 major projects (Of these 13 completed) (b)		5.6	10.7	16.3
Other 506 medium projects (Of these 345 completed) (b)		—	—	37.7
Total				235.0

NOTES : (a) Location indicated according to districts benefited.
(b) Data relate to March-end 1973.

SOURCE : Ministry of Irrigation and Power.

All-India profile

Table 1.6 : Seepage losses in irrigation

Transit medium						Water loss as per cent of head discharge
Main canal/Branches	..	..	..	..	..	17
Distributaries	..	..	..	..	..	8
Water-courses	..	..	..	..	..	20
Field channels	..	..	..	..	..	17
Total	..	..	..	..	..	62

Note : The estimates are for alluvial plains of north India. In heavier soils, the losses would be lower. Losses are heavier on new channels but decrease in course of time as soil pores get sealed. A channel constructed in clay loam is as good as lined channel, i.e., seepage loss is minimal.

SOURCE : Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972, Vol. I, p. 117.**

Table 1.7 : Requirements and productivity of water for cereals

Crop (New strains)				Water requirement in a typical tract (Mm)	Yield per hectare (Kg)	Productivity per mm water (Kg per hectare)
Wheat	..	..	..	400	5,000	12.5
Sorghum/jowar	..	..	..	500	4,500	9.0
Bajra	..	..	..	500	4,500	8.0 (a)
Maize	..	..	..	625	5,000	8.0
Rice	..	..	..	1,200	4,500	3.7

Note : (a) There seems to be a discrepancy in the source cited, as regards working out of productivity per mm water.

SOURCE : Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972, Vol. I, p. 108.**

SECTION A

Table 1.8: Irrigation timings and crop response : Wheat (Sonora 64)

	Crop-age (days)			Yield per hectare (Quintal)	Relative yield (Per cent)
	0-60	60-90	90-120		
Number of irrigations	—	2	2	37.0	100
	1	1	2	44.0	119
	2	1	1	51.3	140
	2	—	2	52.3	141

Note : The data are results of experiments conducted by Indian Agricultural Research Institute at Delhi in 1965. They indicate that in case of wheat, flowering and grain-formation stages are most critical periods for irrigation.

SOURCE : Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. I, p. 107.

Table 1.9: Number of irrigations and crop response : Wheat (Sonora 64)

Number of irrigations				Yield per hectare (Quintal)	Relative yield (Per cent)	Best irrigation schedule (Days after sowing)	
Unirrigated	..	..	..	9.3	100	—	
One	..	..	..	30.4	330	25	
Two	..	..	..	34.2	370	25	65
Three	..	..	..	35.4	380	25	65 105
Four	..	..	..	42.8	450	25, 45, 65 105	
Five	..	..	..	47.8	510	25, 45, 65, 85, 105	

Note : The data are results of experiments conducted on sandy-loam soils.

SOURCE : Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. I, p. 111.

All-India profile

Table 1.10 : Other miscellaneous data (a)

Description											Unit	Value
1.	Net sown area with assured source of water in 1967-68 (a + b)										Per cent	45
	As per cent of total net sown area											
	(a) Net irrigated area in low and medium rainfall regions										Per cent	15
	(b) Net sown area in high rainfall region										Per cent	30
2.	Percentage of net sown area in 1967-68 under										Per cent	100
	(a) High rainfall region											30
	(b) Medium rainfall region											36
	(c) Low rainfall region											34
3.	Percentage of net irrigated area in 1967-68 under										Per cent	100
	(a) High rainfall region											27
	(b) Medium rainfall region											41
	(c) Low rainfall region											32
4.	Potential and utilisation of groundwater resources in 1967-68											
	(a) Net annual recharge										Million acre feet	219
	(b) Net annual draft										Million acre feet	47
	(c) Net annual draft as per cent of net annual recharge										Per cent	21
5.	Ultimate irrigation potential (surface and ground) and utilisation of major, medium and minor projects in States											
	(a) Ultimate irrigation potential as per cent of net sown area										Per cent	58
	(b) Potential utilised as per cent of ultimate potential										Per cent	38
6.	Irrigation potential created in States through major and medium projects up to the end of 1974-75											
	(a) Potential created as per cent of ultimate potential of major and medium irrigation projects										Per cent	27
	(b) Potential utilised as per cent of potential created										Per cent	81
7.	Net irrigated area as per cent of net sown area										Per cent	
	(a) 1961-62											18
	(b) 1971-72											22
8.	Net area irrigated by sources in 1970-71										Per cent	
	(a) Canals											40
	(b) Tanks											14
	(c) Wells											38
	(d) Others											8
9.	Drought-prone area as per cent of										Per cent	
	(a) Total area											16
	(b) Total population											10
10.	Rural water supply coverage in States as at March-end 1969											
	(a) Total number of villages/hamlets										Number	5,45,877
	(b) Villages/hamlets having water supply through wells, conservation tanks, hand pumps, piped water supply schemes, etc.											4,29,050
11.	Urban water supply and sewerage in States as at March-end 1969											
	Total number of towns										Number	2,921
	(a) Towns covered under											
	(i) Partial or full water supply										Number	1,281
	(ii) Sewerage										Number	188
	(b) Percentage of urban population covered under											
	(i) Partial or full water supply										Per cent	75
	(ii) Sewerage										Per cent	40
12.	Navigable waterways										Km	14,344
	(a) Rivers										Km	10,041
	(b) Canals										Km	4,303

Notes : (a) The data exclude Sikkim.

Corresponding Statewise data are presented in Section B "Regional Profile."

SECTION B

Table 2.1 : States :

Area ('000 sq km)	Population (Lakhs) 1971	Density (Persons per sq km) 1971	Average rainfall (Cm)	Cultivated area as per cent of geographical area 1970-71	Net irrigated area as per cent of net sown area 1970-71	State (a)
Major States (c)						
294 (4)	883 (1)	300 (5)	117 (7)	58 (5)	42 (4)	Uttar Pradesh ..
174 (8)	564 (2)	324 (3)	132 (5)	49 (9)	26 (8)	Bihar ..
308 (3)	504 (3)	164 (9)	106 (8)	60 (4)	8 (15)	Maharashtra ..
88 (11)	443 (4)	504 (2)	174 (3)	63 (3)	27 (6)	West Bengal ..
277 (5)	435 (5)	157 (10)	90 (11)	43 (12)	28 (5)	Andhra Pradesh ..
443 (1)	417 (6)	94 (14)	123 (6)	42 (13)	8 (14)	Madhya Pradesh ..
130 (10)	412 (7)	316 (4)	97 (10)	47 (10)	42 (3)	Tamil Nadu ..
192 (7)	293 (8)	153 (11)	104 (9)	54 (7)	11 (13)	Karnataka ..
196 (6)	267 (9)	136 (13)	81 (12)	51 (8)	13 (12)	Gujarat ..
342 (2)	258 (10)	75 (15)	46 (15)	45 (11)	14 (11)	Rajasthan ..
156 (9)	219 (11)	141 (12)	153 (4)	39 (14)	19 (10)	Orissa ..
39 (15)	213 (12)	549 (1)	267 (1)	56 (6)	20 (9)	Kerala ..
79 (12)	146 (13)	186 (8)	241 (2)	29 (15)	26 (7)	Assam ..
50 (13)	135 (14)	269 (6)	64 (14)	81 (2)	71 (1)	Punjab ..
44 (14)	100 (15)	227 (7)	76 (13)	81 (1)	43 (2)	Haryana ..
Other than major States						
222 (d)	46	N.A.	102	16	40	Jammu and Kashmir ..
56	35	162	184	11	17	Himachal Pradesh ..
11	16	149	193	23	9	Tripura ..
22	11	48	193	8	36	Manipur ..
23	10	45	241	7	23	Meghalaya ..
17	5	31	193	7	12	Nagaland ..
7	2	27	N.A.	N.A.	N.A.	Sikkim ..
3,281	5,480	178	119	46	22	All India ..

NOTES : (a) States are ranked by population.

(b) Agriculturally bad year denotes a drop in agricultural output either due to drought or flood by 5 per cent or more in that particular year compared to the previous peak in production.

Regional profile

ected indicators

Percentage of net area irrigated in 1970-71 by				Number of agriculturally bad years during 1952-53 to 1974-75 (b)	Per hectare value of agricultural production (Rs) 1969-70	Growth rate of production of food-grains (Annual rate of increase between the trienniums ended 1961-62 and 1973-74)	Per capita State income at current prices (Rs) Average of 1967-68 to 1969-70
Canals	Tanks	Wells	Others				
48 (5)	34 (3)	15 (10)	3 (9)	10 (4)	1,237 (6)	1.7 (9)	480 (12)
38 (9)	8 (11)	25 (8)	29 (3)	10 (5)	990 (9)	1.7 (10)	409 (15)
22 (14)	16 (8)	57 (2)	5 (7)	12 (2)	652 (13)	-2.2 (15)	686 (3)
65 (1)	20 (6)	1 (13)	14 (5)	14 (1)	1,754 (3)	2.5 (5)	667 (5)
48 (6)	34 (4)	15 (11)	3 (10)	5 (9)	1,028 (8)	1.0 (14)	537 (10)
48 (7)	9 (10)	38 (5)	5 (8)	7 (8)	642 (14)	1.1 (13)	458 (13)
34 (12)	35 (2)	30 (7)	1 (11)	2 (13)	1,396 (5)	2.3 (7)	558 (7)
37 (10)	32 (5)	23 (9)	8 (6)	5 (10)	883 (11)	3.0 (4)	552 (9)
17 (15)	2 (12)	80 (1)	1 (12)	12 (3)	842 (12)	4.2 (3)	667 (4)
35 (11)	13 (9)	51 (4)	1 (13)	10 (6)	450 (15)	1.7 (11)	455 (14)
23 (13)	51 (1)	4 (12)	22 (4)	9 (7)	915 (10)	1.5 (12)	488 (11)
49 (4)	17 (7)	1 (14)	33 (2)	— (15)	2,174 (1)	2.1 (8)	555 (8)
63 (2)	—	—	37 (1)	4 (11)	1,868 (2)	2.5 (6)	581 (6)
45 (8)	—	55 (3)	—	1 (14)	1,504 (4)	6.5 (1)	940 (1)
62 (3)	—	38 (6)	—	4 (12)	1,087 (7)	4.6 (2)	810 (2)
98	—	—	2		1,429	4.1	426
—	—	1	99		1,110	9.0	585
—	—	—	100		2,119	4.6	532
—	—	—	100		1,702	5.4	458
—	—	—	100		N.A.	1.0	—
—	—	—	100		N.A.	-4.0	420
N.A.	N.A.	N.A.	N.A.		N.A.	N.A.	N.A.
40	14	38	8		992	2.1	551

(c) States with population of one crore and above have been classified as major States.

(d) Includes 1,21,000 sq km illegally occupied by Pakistan and China.

Figures in brackets indicate rank under respective column among major States.

SECTION B

Table 2.2 : Normal rainfall in different regions

Meteorological division	Percentage share of the region in			Normal rainfall (Cm)	Kharif crops	
	Population (1971)	Net sown area (1970-71)	Net irrigated area (1970-71)		Food	Cash
Andhra Pradesh						
Coastal	3.6	2.7	6.6	99	Rice, jowar, bajra, ragi and maize	Castorseed, groundnut, tobacco, mests, cotton and chillies
Telangana	2.9	3.4	2.3	97		
Rayalaseema	1.5	2.2	1.7	66		
Arunachal Pradesh	0.1	—	—	412	Rice	—
Assam (including Meghalaya) ..	2.8	1.7	1.9	241	Rice and maize	Jute and tea
Bihar						
Plateau	2.5	2.1	0.6	136	Rice and maize	Sugarcane, jute, mesta and potato
Plains	7.7	3.9	6.3	122		
Gujarat						
Gujarat region (including Daman, Dadra and Nagar Haveli)	3.4	2.3	1.5	89	Rice, jowar, bajra, and maize	Cotton, groundnut, tobacco and castorseed
Saurashtra, Kutch and Diu ..	2.3	4.4	2.4	58		
Haryana (including Chandigarh and Delhi)	2.5	2.6	4.9	76	Rice and bajra	Cotton and sugarcane
Himachal Pradesh	0.6	0.4	0.3	184	Rice and maize	Apples and potato
Jammu and Kashmir	0.8	0.5	0.9	102	Rice and maize	Apples, saffron and linseed
Karnataka						
Coastal	0.5	0.2	0.3	334	Rice, jowar, bajra, ragi and maize	Sugarcane, groundnut, coffee, safflower and cotton
Interior north	2.0	4.5	1.2	79		
Interior south	2.9	2.6	2.2	80		
Kerala	3.8	1.5	1.4	267	Rice, ragi and tapioca	Coconut, rubber, black-pepper, tea and arecanut
Madhya Pradesh						
East	3.5	5.2	2.2	141	Rice and jowar	Cotton, groundnut, sannhemp, sesamum and chillies
West	4.1	7.8	2.5	107		
Maharashtra						
Konkan and Goa	2.2	0.8	0.1	265	Rice, jowar and bajra	Sugarcane, cotton, groundnut, safflower and chillies
Madhya Maharashtra	3.5	5.4	2.6	68		
Marathwada	1.5	3.4	0.9	82		
Vidarbha	2.1	3.4	1.0	113		
Nagaland (including Manipur, Mizoram and Tripura)	0.6	0.4	0.3	193	Rice	Jute and mesta
Orissa	4.0	4.3	3.7	153	Rice, ragi and maize	Jute, sannhemp, sugarcane and castorseed
Punjab	2.5	2.9	9.2	64	Rice and maize	Cotton, sugarcane and groundnut
Rajasthan						
East	3.3	5.3	4.5	66	Bajra and maize	Sesamum, cotton and sannhemp
West	1.4	5.5	2.3	30		
Tamil Nadu (including Pondicherry)	7.5	4.4	8.4	97	Rice, jowar, and bajra	Groundnut, tea, tobacco, sugarcane and chillies
Uttar Pradesh						
East	9.5	7.0	12.2	111	Rice and maize	Sugarcane, linseed, potato and sesamum
West (Plains)	5.8	4.7	10.3	92		
West (Hills)	0.7	0.6	0.5	179		
West Bengal						
Sub-Himalayan	1.0	0.7	0.4	275	Rice	Jute, mesta, tea and potato
Gangetic	7.0	3.2	4.4	151		
All India (a)	100.0	100.0	100.0	121		

Note : (a) Excludes Sikkim.

SOURCE: Compiled by the Commerce Research Bureau.

Regional profile

Table 2.3 : Availability of assured source of water : 1967-68

(Lakh hectares)

State/ Union Territories	Net irrigated area		High rainfall regions	Areas with reasonably assured water supply (2+3)	Areas with reasonably assured water supply as per cent of net sown area
	Total	Of which in low and medium rainfall regions			
	(1)	(2)	(3)	(4)	(5)
States					
Andhra Pradesh	30.89	30.89	—	30.89	27
Assam and Mizoram	5.74	—	22.35	22.35	100
Bihar	20.11	8.13	66.29	74.42	90
Gujarat	11.08	10.30	7.91	18.21	19
Haryana	11.32	11.32	—	11.32	32
Himachal Pradesh	0.90	0.85	0.35	1.20	22
Jammu and Kashmir	2.79	2.45	2.42	4.87	68
Karnataka	10.82	7.95	9.20	17.15	17
Kerala	4.11	—	21.29	21.29	100
Madhya Pradesh	11.43	5.20	99.06	104.26	59
Maharashtra	12.77	8.39	38.96	47.35	26
Manipur	0.65	—	1.78	1.78	100
Meghalaya	0.37	—	1.58	1.58	100
Nagaland	0.12	—	0.47	0.47	100
Orissa	8.34	—	60.44	60.44	100
Punjab	23.34	23.34	—	23.34	58
Rajasthan	18.65	18.65	—	18.65	12
Tamil Nadu	26.29	20.93	10.23	31.16	51
Tripura	0.17	—	2.35	2.35	100
Uttar Pradesh	56.57	50.73	19.00	69.73	40
West Bengal	14.78	—	55.69	55.69	100
Union Territories	0.58	0.25	2.52	277	83
All-India (a) Lakh hectares	271.82	199.38	421.89	621.27	44.5
As per cent of net sown area of the country		14.3	30.2	44.5	

NOTE : (a) Excludes Sikkim.

SOURCE : Ministry of Agriculture, Directorate of Economics and Statistics, Indian Agriculture in Brief, Eleventh and Thirteenth Editions, September 1972 and March 1974.

SECTION B

Table 2.4 : Net sown area located in high, medium and low rainfall regions : 1967-68

State/Union territories	In high rainfall region : 115 cm (45 inches) and above		In medium rainfall region : 75 cm (30 inches) to 115 cm (45 inches)		In low rainfall region : Upto 75 cm (30 inches)		In all regions		Percentage of net sown area under high and medium rainfall regions	
	'000 hectares	Per cent	'000 hectares	Per cent	'000 hectares	Per cent	'000 hectares	Per cent		
States in which at least half of net sown area falls within high and medium rainfall regions										
Assam and Mizoram	2,235	100	—	—	—	—	2,235	100	100	
Bihar	6,629	80	1,655	20	—	—	8,284	100	100	
Himachal Pradesh	35	7	512	93	—	—	547	100	100	
Kerala	2,129	100	—	—	—	—	2,129	100	100	
Manipur	178	100	—	—	—	—	178	100	100	
Meghalaya	158	100	—	—	—	—	158	100	100	
Nagaland	47	100	—	—	—	—	47	100	100	
Orissa	6,044	100	—	—	—	—	6,044	100	100	
Tamil Nadu	1,023	17	5,060	83	—	—	6,083	100	100	
Tripura	235	100	—	—	—	—	235	100	100	
West Bengal	5,569	100	—	—	—	—	5,569	100	100	
Madhya Pradesh	9,906	56	7,055	39	836	5	17,797	100	95	
Jammu and Kashmir	242	34	379	53	95	13	716	100	87	
Uttar Pradesh	1,900	11	13,080	75	2,487	14	17,467	100	86	
Union Territories	252	75	—	—	82	25	334	100	75	
Andhra Pradesh	—	—	7,286	64	4,081	36	11,367	100	64	
Maharashtra	3,896	21	7,734	43	6,637	36	18,267	100	64	
States in which less than half of net sown area falls within high and medium rainfall regions										
Karnataka	920	9	2,397	24	6,670	67	9,987	100	33	
Gujarat	791	8	2,447	25	6,564	67	9,802	100	33	
Punjab	—	—	609	15	3,383	85	3,992	100	15	
Rajasthan	—	—	1,748	12	13,349	88	15,097	100	12	
Haryana	—	—	238	7	3,276	93	3,514	100	7	
All-India	42,189	30	50,200	36	47,460	34	1,39,849	100	66	

SOURCE : Ministry of Agriculture, Directorate of Economics and Statistics, Indian Agriculture in Brief, Thirteenth Edition, March 1974

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Table 2.5 : Net irrigated area located in high, medium and low rainfall regions: 1967-68

State/Union territories	In high rainfall region : 115 cm (45 inches) and above		In medium rainfall region : 75 cm (30 inches) to 115 cm (45 inches)		In low rainfall region : Upto 75 cm (30 inches)		In all regions		Percentage of net irrigated area under high and medium rainfall regions	
	'000 hectares	Per cent	'000 hectares	Per cent	'000 hectares	Per cent	'000 hectares	Per cent		
States in which at least half of irrigated area falls within high and medium rainfall regions										
Assam and Mizoram	574	100	—	—	—	—	574	100	100	
Bihar	1,198	60	813	40	—	—	2,011	100	100	
Himachal Pradesh	5	6	85	94	—	—	90	100	100	
Kerala	411	100	—	—	—	—	411	100	100	
Manipur	65	100	—	—	—	—	65	100	100	
Meghalaya	37	100	—	—	—	—	37	100	100	
Nagaland	12	100	—	—	—	—	12	100	100	
Orissa	834	100	—	—	—	—	834	100	100	
Tamil Nadu	536	20	2,093	80	—	—	2,629	100	100	
Tripura	17	100	—	—	—	—	17	100	100	
West Bengal	1,478	100	—	—	—	—	1,478	100	100	
Madhya Pradesh	623	54	429	38	91	8	1,143	100	92	
Andhra Pradesh	—	—	2,578	84	511	16	3,089	100	84	
Uttar Pradesh	584	10	3,708	66	1,365	24	5,657	100	76	
Jammu and Kashmir	34	12	175	63	70	25	279	100	75	
Maharashtra	438	34	309	24	530	42	1,277	100	58	
Union Territories	33	57	—	—	25	43	58	100	57	
Karnataka	287	26	258	24	537	50	1,082	100	50	
States in which less than half of irrigated area falls within high and medium rainfall regions										
Gujarat	78	7	275	25	755	68	1,108	100	32	
Rajasthan	—	—	291	16	1,574	84	1,865	100	16	
Punjab	—	—	174	7	2,160	93	2,334	100	7	
Haryana	—	—	25	2	1,107	98	1,132	100	2	
All-India	7,244	27	11,213	41	8,725	32	27,182	100	68	

SOURCE : Ministry of Agriculture, Directorate of Economics and Statistics, **Indian Agriculture in Brief**, Thirteenth Edition, March 1974

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Table 2.6 : Groundwater resources : Potential and utilisation : 1967-68

State/Union Territory (a)	Net annual recharge (b) (Million acre feet)	Net annual draft (Million acre feet)	Net annual draft as per cent of net annual recharge
States			
Rajasthan	3.4	2.07	61
Uttar Pradesh	35.5	17.92	50
Punjab	6.9	3.30	48
Gujarat	10.2	4.13	40
Tamil Nadu	11.5	3.47	30
Maharashtra	12.6	3.41	27
Haryana	3.5	0.75	21
Andhra Pradesh	17.2	3.57	21
Madhya Pradesh	26.7	4.22	16
Bihar	21.9	2.35	11
Karnataka	10.0	1.03	10
West Bengal	16.1	0.36	2
Orissa	16.0	0.15	1
Assam region(c)	16.7	—	—
Kerala	5.4	—	—
Jammu & Kashmir	4.0	—	—
Himachal Pradesh	0.9	N.A.	—
Union Territory			
Delhi	0.3	N.A.	—
All-India	218.8	46.76	21

NOTES : (a) States and Union Territory are ranked by the percentage of net annual draft to net annual recharge.

(b) Net annual-recharge is made up of contribution of rainfall and canal infiltration less losses due to evapotranspiration and sub-surface run-off.

(c) Includes Nagaland, Arunachal, etc.

SOURCE : Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972, Vol. I, p. 55.**

Table 2.7 : Irrigation potential and utilisation of major, medium and minor projects

State	Ultimate irrigation potential (Surface as well as ground)		Potential utilisation in 1970-71 (net irrigated area)	
	'000 hectares	As per cent of net sown area	'000 hectares	As per cent of ultimate potential
Tamil Nadu	3,600	58.4	2,592	72.0
Punjab	6,950 (a)	91.2 (a)	2,888	63.6
Uttar Pradesh	15,100	87.3	7,190	47.6
Jammu and Kashmir	600	85.0	279	46.5
Rajasthan	5,000	32.9	2,132	42.6
West Bengal	4,300	77.6	1,489	34.6
Karnataka	3,400	33.2	1,137	33.4
Andhra Pradesh	10,300	87.8	3,313	32.2
Gujarat	3,800	40.3	1,209	31.8
Maharashtra	4,500	24.6	1,427	31.7
Orissa	4,000	65.4	1,149	28.7
Kerala	1,500	69.1	431	28.7
Bihar	8,000	94.6	2,160	27.0
Assam	2,200	98.8	572	26.0
Nagaland	50	50.0	12	24.0
Madhya Pradesh	8,000	43.6	1,480	18.5
Haryana	(b)	(b)	1,532	(b)
Himachal Pradesh	N.A.	—	91	—
Manipur	N.A.	—	65	—
Meghalaya	N.A.	—	37	—
Tripura	N.A.	—	22	—
All States (c)	81,300	57.7	31,207	38.4

NOTES: (a) Includes Haryana.

(b) Included in Punjab.

(c) Excludes Sikkim.

SOURCES : 1. For ultimate irrigation potential, Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972, Vol. I, pp. 218-219.**

2. For potential utilised, Fertiliser Association of India, **Fertiliser Statistics 1973-74, p. 11-5.**

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Table 2.8: Irrigation potential created through major and medium projects upto the end of 1974-75

State	Ultimate potential of major and medium projects ('000 hectares)	Potential created		Potential utilised	
		'000 hectares	As per cent of ultimate potential	'000 hectares	As per cent of potential created
Kerala	600	239	39.8	239	100.0
West Bengal	2,300	846	36.8	819	96.8
Tamil Nadu	1,500	270	18.0	260	96.3
Haryana	(a)	1,121	(a)	1,078	96.2
Orissa	2,400	839	35.0	803	95.7
Andhra Pradesh	6,500	973	15.0	882	90.6
Jammu and Kashmir	100	47	47.0	42	89.4
Rajasthan	3,200	897	28.0	787	87.7
Punjab	4,100(b)	926	49.9	795	85.9
Uttar Pradesh	7,600	1,797	23.6	1,491	83.0
Karnataka	1,800	636	35.3	472	74.2
Madhya Pradesh	5,600	514	9.2	369	71.8
Maharashtra	2,300	548	23.8	378	69.0
Gujarat	2,100	708	33.7	427	60.3
Bihar	4,400	1,565	35.6	912	58.3
Assam	1,000	54	5.4	26	48.1
Manipur	N.A.	7	—	1	14.3
Himachal Pradesh	N.A.	N.A.	N.A.	N.A.	N.A.
Meghalaya	N.A.	—	—	—	—
Nagaland	N.A.	—	—	—	—
Tripura	N.A.	N.A.	N.A.	N.A.	N.A.
All-States (c)	45,500	12,085	26.6	9,781	80.9

NOTES : (a) Included in Punjab (b) Includes Haryana (c) Excludes Sikkim
 SOURCES : 1. For ultimate irrigation potential, Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972**, Vol. I, pp. 217-219
 2. For potential created and utilised, Planning Commission, **Annual Plan 1975-76**

Table 2.9 : Net sown area and net irrigated area : 1961-62 and 1970-71

State (a)/ Union Territories	1961-62			1970-71		
	Net sown area (^{'000} hec- tares)	Net irrigated area		Net sown area (^{'000} hec- tares)	Net irrigated area	
		^{'000} hec- tares	As per cent of net sown area		^{'000} hec- tares	As per cent of net sown area
States						
Punjab.. ..	7,529	3,210	42.6	4,053	2,888	71.3
Haryana	(b)	(b)	(b)	3,565	1,532	43.0
Tamil Nadu	6,017	2,503	41.6	6,169	2,592	42.0
Uttar Pradesh	17,290	4,859	28.1	17,305	7,190	41.5
Jammua and Kashmir	689	287	41.7	706	279	39.5
Manipur	168	68	40.5	179	65	36.3
Andhra Pradesh	11,290	3,029	26.8	11,735	3,313	28.2
West Bengal	5,436	1,352	24.9	5,542	1,489	26.9
Assam	2,288	612	26.7	2,226	572	25.7
Bihar	8,350	1,942	23.3	8,454	2,160	25.6
Meghalaya	(c)	(c)	(c)	163	37	23.2
Kerala	1,932	327	16.9	2,172	431	19.8
Orissa	5,811	978	16.8	6,119	1,149	18.8
Himachal Pradesh	274	39	14.2	544	91	16.7
Rajasthan	13,743	1,823	13.3	15,179	2,132	14.0
Gujarat	9,563	750	7.8	9,428	1,209	12.8
Nagaland	47	12	25.5	100	12	12.0
Karnataka	10,264	920	9.0	10,248	1,137	11.1
Tripura	227	13	5.7	240	22	9.2
Madhya Pradesh	16,251	944	5.8	18,352	1,480	8.1
Maharashtra	18,053	1,081	6.0	18,304	1,427	7.8
Union Territories	132	53	40.2	378	85	22.5
All-India (d)	1,35,354	24,802	18.3	1,41,161	31,292	22.2

NOTES : (a) States are ranked by the last column (c) Included in Assam
 (b) Included in Punjab (d) Excludes Sikkim
 SOURCES : 1. Central Statistical Organisation, **Statistical Abstract of the Indian Union, 1966**, March 1967
 2. Fertiliser Association of India, **Fertiliser Statistics, 1973-74**, December 1974

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Table 2.10 : Irrigation by sources : 1970-71

(Per cent)

State/ Union territories	Canals			Tanks	Wells	Others	Total
	Government	Private	Total				
States							
Andhra Pradesh ..	47.7	—	47.7	33.6	15.4	3.3	100.0
Assam	12.4	50.9	63.3	—	—	36.7	100.0
Bihar	37.6	0.1	37.7	7.8	25.5	29.0	100.0
Gujarat	16.9	0.2	17.1	2.5	79.6	0.8	100.0
Haryana	62.1	—	62.1	0.1	37.5	0.3	100.0
Himachal Pradesh..	—	—	—	—	1.0	99.0	100.0
Jammu and Kashmir ..	22.2	75.3	97.5	—	0.4	2.1	100.0
Karnataka	36.8	0.2	37.0	32.1	22.8	8.1	100.0
Kerala	46.6	2.3	48.9	16.9	1.2	33.0	100.0
Madhya Pradesh ..	47.9	—	47.9	8.8	38.0	5.3	100.0
Maharashtra	19.6	2.3	21.9	15.8	57.5	4.8	100.0
Manipur	—	—	—	—	—	100.0	100.0
Meghalaya	—	—	—	—	—	100.0	100.0
Nagaland	—	—	—	—	—	100.0	100.0
Orissa	20.1	2.8	22.9	50.7	3.9	22.5	100.0
Punjab	44.5	0.2	44.7	—	55.1	0.2	100.0
Rajasthan	35.5	—	35.5	12.7	50.8	1.0	100.0
Tamil Nadu	34.1	—	34.1	34.6	29.9	1.4	100.0
Tripura	—	—	—	—	—	100.0	100.0
Uttar Pradesh	34.7	—	34.7	5.2	56.1	4.0	100.0
West Bengal	42.3	22.3	64.6	20.3	1.1	14.0	100.0
Union Territories ..	28.2	1.1	29.3	8.3	51.8	10.6	100.0
All-India (a)	37.1	2.9	40.0	14.5	37.8	7.7	100.0

NOTE : (a) Excludes Sikkim

SOURCE : Ministry of Agriculture, Directorate of Economics and Statistics, Indian Agriculture in Brief, Thirteenth Edition, March 1974

Table 2.11 : Drought-prone areas

State(a)	Area		Population	
	'000 sq km	As per cent of State's total area	Lakhs (1971)	As per cent of State's total population
Karnataka	104	54	141	48
Andhra Pradesh	102	37	109	25
Gujarat	69	35	64	24
Haryana	8	18	19	19
Tamil Nadu	31	24	70	17
Maharashtra	62	20	81	16
Rajasthan	106	31	31	12
Madhya Pradesh	44	10	42	10
All-India(b)	526	16	557	10

NOTES : (a) States are ranked by the last column.

(b) Excludes Sikkim.

According to the source indicated below there are no drought-prone areas in other States. Names of district-wise drought-prone talukas are given under the respective state write-ups.

SOURCES : 1. Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972.
2. Various Census Documents.

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Table 2.12 : A. Traditional and modern water-lifts : 1971

State	Number of traditional lifts	Number of modern lifts		
		Pumpsets	Tubewells	
			Private	State
Andhra Pradesh	3,13,849	1,65,499	15,738	11
Assam	—	—	15	22
Bihar	1,45,350	79,204	10,239	1,274
Gujarat	3,85,489	1,45,673	447	828
Haryana	17,574	46,372	34,259	935
Jammu and Kashmir	20	—	—	59
Karnataka	1,45,951	1,25,844	338	—
Madhya Pradesh	5,17,370	57,123	181	73
Maharashtra	4,09,543	3,05,993	—	5
Punjab	76,197	92,675	62,018	845
Rajasthan	5,99,622	33,439	473	52
Tamil Nadu	4,97,165	4,68,215	25,543	23
Uttar Pradesh	9,78,142	1,44,418	1,19,899	9,404
West Bengal	—	—	9,458	1,298
All-India	40,86,272	16,64,455	2,78,608	14,829

B. Estimates of groundwater withdrawal for various types of groundwater structures

(Acre feet per unit)

State	Traditional open well	Pumpset	Tubewell	
			Private	State
Andhra Pradesh	5	12	20	200
Bihar	8	16	40	300
Gujarat	8	16	40	200
Haryana	8	20	40	250
Karnataka	5	12	20	—
Madhya Pradesh	5	12	40	250
Maharashtra	5	12	—	200
Punjab	8	20	40	250
Rajasthan	8	20	40	300
Tamil Nadu	5	12	15	200
Uttar Pradesh	8	20	40	300

SOURCE : Dhawan B. D., "Economics of Groundwater Utilisation: Traditional versus Modern Techniques", *Economic and Political Weekly*, June 1975.

Table 2.13: Rural water supply coverage : March-end 1969

State	Total number of villages (a)	Number of villages having water supply through wells, conservation tanks, hand pumps, piped water supply schemes, etc.	Percentage of rural population covered with water supply
Kerala	1,574	1,636 (b)	100
Gujarat	18,584	17,541	97
Tamil Nadu	14,124	18,460 (b)	93
Uttar Pradesh	1,12,624	1,00,798	89
West Bengal	38,530	48,166 (b)	89
Madhya Pradesh	70,414	64,343	84
Punjab	21,269	9,545	73
Maharashtra	35,851	15,196	60
Nagaland	814	548	60
Orissa	46,466	22,576	52
Assam and Meghalaya	25,702	13,373	50
Karnataka	26,377	17,741	49
Rajasthan	32,240	15,550	39
Jammu and Kashmir	6,559	3,000	33
Andhra Pradesh	27,084	27,472 (b)	32
Bihar	67,665	52,665	29
Haryana	—	440 (c)	7
Total	5,45,877	4,29,050	—

NOTES : (a) The reference year of number of villages has not been indicated in the source. Perhaps it is 1961 as most of the figures tally with 1961 Census figures. However, according to the 1961 Census the total number of villages in Assam and Meghalaya was 9,339, whereas in the above table it is given as 25,702. Similarly, the number of villages in West Bengal (1961 Census) was 38,454. Number of villages in Haryana has not been given. If it is presumed that these have been included in Punjab, the figure of 21,269 for Punjab (including Haryana) is higher than the 1961 Census figure of 18,616.

(b) Includes hamlets.

(c) Relates to villages covered under piped water supply scheme only.

SOURCE : Dave, J. M., "The Progress of Community Water Supply in India", *Souvenir on United Nations Seminar on Water Resources Administration*, Central Water and Power Commission, Ministry of Irrigation and Power, January 1973.

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Table 2.14 : Urban water supply and sewerage : 1969

State/ Union Territories	Total number of towns 1971	Towns having partial or full			
		Water supply		Sewerage	
		Number	Percentage of population covered	Number	Percentage of population covered
States					
Andhra Pradesh	207	67	70	3	20
Assam	74	19	40	—	—
Bihar	161	46	60	2	20
Gujarat	217	77	70	10	20
Haryana	65	44	73	18	40
Himachal Pradesh	35	30	100	3	5
Jammu and Kashmir	45	40	93	—	—
Karnataka	231	155	83	20	25
Kerala	88	15	60	1	5
Madhya Pradesh	242	91	67	11	15
Maharashtra	289	138	90	22	55
Manipur	8	1	90	—	—
Meghalaya	5	2	80	—	—
Nagaland	3	3	80	—	—
Orissa	80	46	85	1	3
Punjab	108	41	60	31	45
Rajasthan	157	107	90	3	5
Tamil Nadu	443	132	70	20	30
Tripura	6	1	20	—	—
Uttar Pradesh	293	149	87	30	52
West Bengal	137	56	80	7	30
Union Territories					
Andaman and Nicobar	11	1	100	—	—
Arunachal Pradesh	—	—	—	—	—
Chandigarh	1	1	98	1	90
Dadra and Nagar Haveli	—	—	—	—	—
Delhi	3	3	98	3	80
Goa, Daman and Diu	13	11	80	1	15
Lakshadweep	—	—	—	—	—
Pondicherry	5	5	95	1	30
All-India (a)	2,921	1,281	75	188	40

NOTE : (a) Excludes Sikkim

SOURCE : Dave, J. M., "The Progress of Community Water Supply in India", Souvenir on United Nations Seminar on Water Resources Administration, Central Water and Power Commission, Ministry of Irrigation and Power, January 1973.

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Table 2.15: Navigable waterways

State/ Union Territory(a)	Length of navigable waterways (Km)			Per cent
	Rivers	Canals	Total	
States				
Uttar Pradesh ..	2,268	173	2,441	17
West Bengal ..	1,555	782	2,337	16
Andhra Pradesh ..	309	1,690	1,999	14
Assam	1,983	—	1,983	14
Kerala	840	708	1,548	11
Bihar	937	325	1,262	9
Orissa	761	224	985	7
Maharashtra ..	501	—	501	4
Karnataka	284	160	444	3
Gujarat	286	—	286	2
Tamil Nadu	—	216	216	1
Union Territory				
Goa, Daman and Diu	317	25	342	2
All India (b)	10,041	4,303	14,344	100

NOTES : (a) Ranked by the last column

(b) Excludes Sikkim

SOURCE : Transport Research Division, Ministry of Shipping and Transport, **Pocket-Book on Transport in India, 1970-71**

Table 2.16: Capital outlay on major and medium irrigation projects

(Rs crores)

State	1973-74	Cumulative up to 1973-74	Percentage to total
Andhra Pradesh	20.50	377.05	10.8
Assam	—	—	—
Bihar	38.72	297.89	8.5
Gujarat	25.23	264.46	7.6
Haryana	11.73	124.52	3.6
Himachal Pradesh	—	—	—
Jammu and Kashmir	4.29	9.85	0.3
Karnataka	30.30	289.54	8.3
Kerala	0.44	54.00	1.5
Madhya Pradesh	33.67	185.55	5.3
Maharashtra	45.60	342.34	9.8
Orissa	21.66	197.15	5.7
Punjab	7.81	256.60	7.4
Rajasthan	23.08	272.25	7.8
Tamil Nadu	7.88	130.34	3.7
Uttar Pradesh	43.79	481.16	13.8
West Bengal	13.45	204.21	5.9
Total	328.24	3,486.91	100.0

SOURCE : Report of the Sixth Finance Commission, 1973, p. 209

Table 2.17: Per hectare costs of irrigation through major and medium irrigation schemes : 1970

State	Schemes (Number)		Cost per hectare (Rupees)	
	Com- pleted	Conti- nuing	Com- pleted	Conti- nuing
Andhra Pradesh	33	21	1,016	2,721
Assam	—	5	—	1,067
Bihar	29	24	516	1,067
Gujarat	47	12	1,910	2,483
Haryana	3	6	(a)	507(b)
Jammu and Kashmir	4	3	1,273	3,417
Karnataka	12	20	3,432	3,541
Kerala	12	7	1,448	3,951
Madhya Pradesh	26	30	2,088	3,292
Maharashtra	44	41	2,365	3,514
Orissa	—	15	—	1,559
Punjab	11	2	1,255	1,228
Rajasthan	44	15	1,320	2,642
Tamil Nadu	16	14	1,533	3,889
Uttar Pradesh	52	13	793(c)	1,189
West Bengal	4	5	806	1,055

NOTES : (a) Bhakra Nangal project included in Punjab.

(b) Cost of Beas unit I included in Haryana and of Beas unit II in Punjab, as no separate benefits are available.

(c) Benefits of Bhandar Canal included under Matatila project as no separate cost available for the scheme.

SOURCE : Ministry of Irrigation and Power, **Report of the Irrigation Commission, 1972, Vol. I, p. 270**

SECTION B

Regional prof

Table 2.18: Irrigation rates and value of produce: Rice and wheat

State	Rice			Wheat		
	Water rate per hectare (Rs.)	Value of produce per hectare (Rs.)	Percentage share of water rate in value of produce	Water rate per hectare (Rs.)	Value of produce per hectare (Rs.)	Percentage share of water rate in value of produce
Andhra Pradesh	.. 37.5	1,406	2.6	—	—	—
Bihar ..	.. 37.5	553	7.0	22.5	818	2.7
Gujarat ..	.. 45 to 62.5	1,377	3.2 to 4.5	45 to 62.5	1,417	3.1 to 4.4
Haryana ..	.. 24.4	773	3.1	14.5	1,262	1.1
Karnataka ..	.. 40	1,092	3.6	—	—	—
Kerala ..	.. 12.5 to 25	1,556	0.8 to 1.6	—	—	—
Madhya Pradesh	.. 25	1,090	2.3	10 to 25	791	1.2 to 3.1
Maharashtra ..	.. —	—	—	22.5	773	2.9
Orissa ..	.. 2.5 to 20	N.A.	N.A.	—	—	—
Punjab ..	.. 24.4	716	3.4	14.6	1,353	1.1
Rajasthan ..	.. —	—	—	13.1 to 25	1,055	1.2 to 2.3
Tamil Nadu ..	.. 40 to 50	1,120	3.5 to 4.4	—	—	—
Uttar Pradesh	.. 10 to 35	781	1.2 to 4.4	10 to 30	1,041	0.9 to 2.8
West Bengal ..	.. 13.4 to 13.25	1,699	0.8 to 1.8	—	—	—

NOTE : Value of produce per hectare is based on yield per hectare (1967-68) and harvest price at farm level (1967-68 or 1968-69)

SOURCE : Ministry of Irrigation and Power, Report of the Irrigation Commission, 1972, Vol. I, pp. 271-272

Table 2.19: Expenditure on natural calamities like floods and droughts by State Governments

				(Rs crores)		
State (a)				1972-73 (Account)	1973-74 (Revised estimates)	1974-75 (Budget estimates)
Maharashtra ..	..	..	..	92.22	142.20	4.17
Rajasthan ..	..	..	..	20.03	60.04	13.19
Gujarat ..	..	..	..	31.13	46.10	7.38
Andhra Pradesh ..	..	..	..	29.96	23.36	4.31
Uttar Pradesh ..	..	..	..	16.48	24.97	12.00
West Bengal ..	..	..	..	26.73	16.09	5.73
Karnataka ..	..	..	..	25.00	18.14	1.85
Orissa ..	..	..	..	14.61	11.67	3.59
Bihar ..	..	..	..	19.19	4.38	4.61
Madhya Pradesh ..	..	..	..	7.03	11.80	7.72
Tamil Nadu ..	..	..	..	6.97	8.25	3.06
Assam ..	..	..	..	1.92	0.84	1.25
Kerala ..	..	..	..	0.41	2.93	0.30
Haryana ..	..	..	..	0.98	1.08	0.20
Punjab ..	..	..	..	0.33	1.15	1.17
Tripura ..	..	..	..	1.25	0.97	0.11
Jammu and Kashmir ..	..	..	..	0.57	0.67	0.30
Manipur ..	..	..	..	0.39	0.30	0.05
Meghalaya ..	..	..	..	0.16	0.21	0.26
Nagaland ..	..	..	..	0.21	0.27	0.12
Himachal Pradesh ..	..	..	..	0.03	0.03	0.03
All States ..	..	..	..	295.60	375.45	71.40

NOTE : (a) States are ranked by average expenditure for three years.

SOURCE : Reserve Bank of India, "Finances of State Governments: 1974-75," Reserve Bank of India Bulletin, September, 1974.

KIRLOSKAR OIL ENGINES LIMITED

PUNE-411 003

Chairman, Shri S. L. Kirloskar's Speech

TEXT of the speech delivered by Shri S. L. Kirloskar, Chairman & Managing Director of Kirloskar Oil Engines on the occasion of the ANNUAL GENERAL MEETING of the shareholders of the Company held at Pune on Saturday, the 27th September, 1975 at 11.00 A.M.

LADIES AND GENTLEMEN,

I welcome you this morning, for the 29th Annual General Meeting of your company.

All of you must have gone through the Directors' Report and the Audited Accounts of the Company for the year 1974-75 and I shall take them as read.

I am sure, you must have been heartened to note the record sales of Rs 366.3 Million from Rs 279.7 Million in the previous year. The profits before taxes also went up to Rs 25.3 Million from Rs 21.2 Million in the previous year. The slight decrease in profitability is due to higher exports. The profits after tax however have declined to Rs 8.4 Million from Rs 8.7 Million. This is largely due to non-availability of Development Rebate on the additions of machinery during the year. In view of the consistent dear money policy and the credit squeeze, your Directors have decided to conserve the funds for being utilised in the recurring expansion and diversification programmes of the Company.

The year under review continued to be difficult due to drought conditions. The money supply position continued to be hard with unprecedented rise in the rates of interest. In spite of all these difficulties, your Company has done well.



SHRI S. L. KIRLOSKAR

On the International scene also, the perturbed economic conditions, due to the oil crisis, consequent inflation, continued. The year was marked with frequent changes in the parity rates of exchange. There was however an improvement in demand for diesel engines. The Company was able to get a due share of this market and the international sales have reached to Rs 60.1 Million, an increase of 80 per cent over the previous year.

In a country like ours, which is predominantly agricultural, the national economy to a large extent depends on the agricultural production. By and large there has been good monsoon all over the country and the kharif crop has yielded 114 million tonnes of foodgrains. But, this is not a time for us to be complacent. This agricultural production, though by no means a small achievement, is slightly more than the bumper crop achieved earlier in 1970-71, and considering a rise in population of approximately 11 per cent during the past five years,

this achievement is too inadequate. It appears as though we as a nation have yet to strive and struggle hard to come out of the age of shortages.

In India, to-day, we can speak of having arrested the inflationary pressures to a large extent. But having combated these pressures successfully, we are caught up in the recessionary tendencies and increasing unemployment. In this context, I think, the requirements of the existing Industrial Undertakings do need very careful attention from the Government. Your Company has been following the policy of replacing its aged and worn-out machinery and equipment, through its own retained earnings and this is mostly true of many of the engineering units of our size. With our system of taxation, however, we are hardly left with any funds for such replacement and finding it very difficult to replace the old machinery in time.

The markets all over the world are changing and we have to think of modernising our own plants to equip ourselves better, to cater to such changing markets. This is difficult mainly due to two reasons:—

1. The almost negligible depreciation allowance we get is more than offset by the increase in the prices of the machine tools and the existing industry faces acute shortage of funds for replacement of worn-out machinery they have been using.

2. The technology is itself changing so fast that the entrepreneur must constantly go on developing better pro-

duction methods with better and better equipment.

With our system of taxation, I think one just cannot think of such a renovation or rationalisation, through one's own resources. This results in placement of worn-out production machinery and consequently mounting costs making the product uncompetitive in the markets, both domestic and international. To my mind therefore the solution to the problem can only come out of pragmatic and bold taxation policies by Government.

You will kindly recall that on a similar occasion in September, 1972, I had spoken in details about the Payment of Bonus Act. I had expressed my disagreement with the Government of India in treating Bonus as a deferred wage instead as a concept of profit sharing. I am happy that this year, Government of India, has revised their basic thinking and has come out with an Ordinance amending the original Act. Under this Ordinance bonus has been accepted as a share in profits and has done away with the payment of minimum bonus, wherever there are no profits for an undertaking.

The Current year, I feel is flooded with mixed trends. On one side, Government of India has tackled the inflation successfully. On the other hand, we are caught up in a recession and rising unemployment. It is difficult to say with exactness, how we will do in this year. The Company has done well during the past six months and has improved on its previous years performance and with cautious optimism, I would say that we are striving to improve upon our last year's performance.

The commercial production of our engine developed in

our own Research & Development has just commenced. This is a very advanced type of engine with high speed, low weight and comparatively low fuel consumption and is in keeping with the advanced trends in diesel engine industry worldwide. Development of further models of engines in the same series is in progress. I am sure, this will help us not only in the domestic market but overseas as well, in years to come.

I would now like to cover briefly Subsidiaries and then the Companies in which your Company has investments:—

OUR SUBSIDIARIES:

1. Kirloskar Kisan Equipment Limited

This Company had successfully developed a petrol engine with applications in agricultural spraying and dusting. The various manufacturers of such dusters and sprayers, after exhaustive

trials, had found this engine suitable for powering their equipment. However, due to sudden change in the Government policy for procurement of cash crops such as cotton, these equipment manufacturers had to slow down their manufacturing programmes and hence this company also had to revise its manufacturing and marketing strategies. The Company has now undertaken manufacture and marketing of small 35 c. c. petrol engine suitable for cycle rikshaws and bicycles. The trials have been completed successfully and Road Transport authorities in some states have passed it for use on roads.

2. Shivaji Works Limited

Our subsidiary at Sholapur has reported one more successful year with increased sales of Rs 34.76 Million and profits for Rs 3.2 Million. Their efforts in diversifying their markets for castings are meeting with success and they have now launched a

further expansion plan by installing one more electric furnace. I am sure that in spite of the current difficult situation, the Company would improve over its last year's performance.

COMPANIES IN WHICH WE HAVE INVESTMENT:

3. Bharat Forge Company Limited

This company has reported another successful year ending 30th June, 1975 with a turnover of Rs 178.15 Million and has recommended a dividend of 12 per cent on the Equity Share Capital.

4. Kirloskar Cummins Limited

Kirloskar Cummins Limited has completed another good year ending 30th September, 1975 with increased turnover. This company has been allowed the expansion of its activities from 2,500 engines to 6,400 engines per year.

5. Poona Industrial Hotels Limited

Hotel Blue Diamond has reported improved occupancy and sales during the year ended 30th June, 1975 and has made a net profit of Rs 0.44 Million.

6. Kirloskar Tractors Limited

This company has almost completed substantial portion of main manufacturing plant at Nasik Road. So far, the company has manufactured and sold more than 1,000 tractors and these have been well received in the market for their reliability, performance and low fuel consumption. They would shortly take up the production of tractors of nearly 70 HP.

7. G. G. Dandekar Machine Works Limited

G. G. Dandekar Machine Works Limited continued to face the labour unrest and had to face a major strike by the workers from 18-11-1974 to 9-2-1975. Despite these

difficulties, the company reported increased sales and has made a profit of Rs 1.5 Million during the year ended 30th June, 1975.

8. Mahila Udyog Limited

This company has 1 well and has proposed a dividend of 12 per cent for year ended 30th June, 1975.

9. Kirloskar Industries (Phils) Inc

Kirloskar Industries (P) Inc also had a successful year with increased sales of Philippine Pesos 4.2 Million. In view of its increased activities in Philippines, the company has decided to increase its capital base by issue of Right Shares.

10. Indo-Malaysia Engg (Berhad)

This company had a very successful year and has recommended a dividend of 12 per cent on the Equity Share Capital.

11. F. H. Schule GmbH

This company has reported very satisfactory working results for the year ended 31st December, 1974 with sales of DM 22.6 Million.

All the financial institutions and the bankers, have co-operated in extending financial assistance, so essential for the activities of the Company and I am sure, we can count on their continued co-operation. I would like to place on record our appreciation for this co-operation.

Our results are largely due to the enthusiasm and loyalty of our workmen and staff and harmonious able administration of our management team. I invite you to join me in their appreciation.

Thank you.

(Note: This does not purport to be a record of the proceedings of the 29th Annual General Meeting of the Company.)

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COMPANY MEETING:**DELHI CLOTH & GENERAL MILLS COMPANY LIMITED*****Speech of the Chairman, Board of Directors, Dr Bharat Ram***

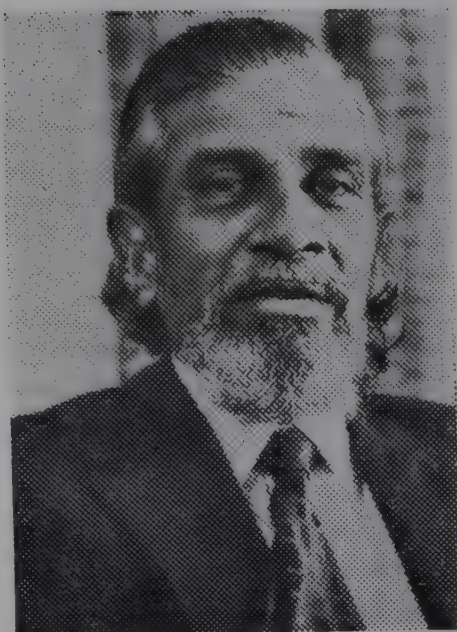
FOLLOWING is the speech of Dr Bharat Ram, Chairman, Board of Directors delivered at the 87th Annual Meeting of the Company held on December 29, 1975 at Delhi.

LADIES AND GENTLEMEN,

I have great pleasure in welcoming you to the 87th Annual General Meeting of your Company and wishing all the shareholders, their families and friends a better 1976 in every way.

The Directors' Report and the audited Statement of Accounts for the year ended 30th June, 1975 have already been circulated. In view of the provisions of the Companies (Temporary Restrictions on Dividends) Act 1974, the Directors have recommended the maximum dividend permissible.

As you will see from the Directors' Report all other industries have done well except Textiles. Since last year this industry has been in a particularly difficult position and the scheme of controlled cloth has added to the problem. This particular scheme is not only adversely affecting the organised industry, but also the handloom and powerloom sectors, which have to compete with the controlled cloth. The spinning mills in the organised sector are especially hard-hit because there is no off-take from the handloom and powerloom sectors, in spite of a drop in cotton



DR BHARAT RAM

prices and yarn prices. Government too have started recognising the complexity of the situation and are endeavouring to liberalise the distribution system so far as controlled cloth is concerned. In my judgement this by itself will not tackle the main issues. What is called for is an upward revision of the price of controlled cloth and this will save the industry as well as the handloom and powerloom units. In addition to the general problems of the textile industry, our units both at Dasna and Hissar suffered due to shortage of power supply which has greatly affected the production and the profitability.

When we met last on the 30th December 1974, our economy had just started recovering from the high-speed inflation that overtook us since early June 1972. For the first time in the post-independence period, the rate of price rise was more than 2

per cent per month. It is only natural that Government launched a concerted attack on inflation and from July 1974 a series of stringent measures were taken by way of partial wage and salary freeze, Compulsory Deposit Scheme, restrictions on dividends, anti-hoarding and anti-smuggling devices, etc. I had occasion, in my statement to you last year, to give my thoughts on some of the measures like the Companies (Temporary Restrictions on Dividends) Act 1974 and the credit squeeze which was in operation since November 1973. I do not propose to repeat them again except to observe that unhappily my apprehensions have come true.

In the very nature of things demand management anti-inflationary measures have in them the seeds of recession. It is necessary therefore to be sensitive to the situation and take a view as to when an arrest in inflationary pressures would develop into a recession. I am afraid this important fact has not been appreciated by the authorities so much so several industrial units have closed down and many are compelled to hold excessive stocks. The profits of industry have generally come down and some undertakings are actually losing.

It has come to be said that there has been a transformation in our economy, that we have moved from the position of shortages to that of

surpluses, that there has been a change in the consumer preferences or that there is a divergence between the old production pattern and the new requirements of the market. I have given considerable thought to this kind of opinion and I must express my disagreement.

Apart from the fact that overnight the tastes of consumers cannot change, the overall production figures do not lend support to the thesis that substantial surpluses have occurred. But a more fundamental fact is that a developing country like ours, with one of the lowest per capita incomes in the world, cannot suffer from over-production. I submit that we have got to look to other causes for the malaise.

Before I proceed to outline my analysis, it is as well that I give a broad brush picture of our economy. When compared to 1974, 1975 did provide us with a number of favourable factors. In the last one year prices declined by more than 5 per cent. There has been a remarkable improvement in the agricultural output; foodgrains production in 1975-76 will reach the targeted level of 114 million tonnes; the constraints which plagued us in 1974 like inadequacy of raw materials, power shortage, industrial disputes, transport bottlenecks, etc have almost disappeared. Even so, most of the industries are unable to take advantage of these

favourable factors for the simple reason that the demand did not pick up.

I believe that the demand-management policies of Government have continued beyond their usefulness or necessity. For instance, credit expansion in 1974-75 busy season was only Rs 982 crores as against Rs 1,406 crores in the busy season of the previous year. Even this does not give an indication of the credit made available to industry and trade. For, there has been larger allocation of credit to food procurement and other priority sectors like agriculture. Hence the availability of credit to industry and trade got sharply reduced. In the last busy season, credit to these sectors including export credits rose only by Rs 482 crores as compared to Rs 1,003 crores in the busy season of 1973-74. Since last September, the Guidelines of the Tandon Study Group, relevant to an inflationary situation, have come to be applied. The interest rates continue to rest at hiked up levels anywhere between 16 to 21 per cent. Export credit too is available only at the stepped up rate of 10 per cent.

Against this background, the various steps taken by Government in the last quarter of 1975 by way of removing controls on construction activity, liberalisation of controlled cloth distribution, incentive plan for sugar industry, excise relief to mini-steel products, relaxation in the procedure relating to production and exports, have not had their desired impact. Time is the essence and unless adequate remedial measures are taken speedily, the present situation may get out of hand.

In my judgement, without claiming any special insight, it will be dangerous to place undue confidence in some narrow and random indicators which may suggest that the economy is poised for faster growth in the coming months. The declaration of

Emergency has certainly given a new sense of direction to our economy, but its depth will depend upon taking some other unconventional measures. First and foremost, there has to be a rationalisation of the excise structure. Such rationalisation will not adversely affect the overall revenue collection. In the unlikely event revenues were to fall, this should be treated as a component of deficit financing. I can anticipate a counter argument: It is that we may end the current financial year with great deficit than budgeted for, and that in any case, Plan outlay has been increased by about Rs 1,100 to Rs 5,978 crores which should help stimulate demand. What is forgotten is that much of the outlay has gone to capital heavy projects like oil exploration and refining, power generation, fertilizers, major irrigation etc. which have a long gestation period and what is more do not put purchasing power in the hands of the large number of people through substantial increased employment. Otherwise, I cannot see as to why the additional expenditures of Government should not have generated the demand for goods and services. It is essential that Governmental outlays are really such that without their being infructuous as mere expenditure, they create employment as well as new demand. Construction of all kinds and road transport come readily to the mind. For it is not as if we have enough houses or roads or vehicles. Such activities are not only important in themselves, but more importantly stimulate production and employment in a large variety of industries.

A bold action requires to be taken in the field of direct taxation also. While the tightening of tax administration is good as far as it goes to stem tax evasion, it will be unrealistic to assume that with the present levels of direct taxation—even though the marginal

rates were reduced some time back—there will not be temptation to avoid taxes. Experience has shown that by the reduction of taxes at the highest slabs, the revenues of Government have not come down, but, on the other hand, have gone up. I make bold to suggest that the highest tax rate should not exceed 60 per cent. To my way of thinking, while Government should come down heavily on those who evade taxes, the policy frame should be such as to encourage honest tax payer.

In the field of corporate taxation it should be possible by a simple amendment to restore many sick units back to health. At present, if a prosperous and going company takes the overall liabilities of a sick unit, the liabilities of the latter cannot be set off against the profits of the former. In fact, ironically enough the position is the other way round. The prosperous company has got to amalgamate with the losing concern. This position has to be reversed. If necessary, Government may appoint a Commissioner for Amalgamations, who will take a view on applications for amalgamations taking into account the importance of the industry, investments by public financial institutions, etc.

It will be recognised that the health of an existing industrial undertaking depends upon its capacity to replace old machinery in time and to expand. Neither depreciation allowance, nor accelerated depreciation allowance helps in this behalf, and, therefore, a scheme of Development Rebate was evolved by our Government. The scheme, without doubt, helped the growth as well as diversification of industries. Unfortunately, Government decided to withdraw this important allowance at a time when inflation was almost at its worst. However, perhaps realising the implications, Government since set up a high-powered Committee to look into the problem of new

investment in the context of higher capital cost. I do and trust that development rebate in some form or other will be reintroduced. In this connection, there is a special problem in the case of new units whose capital cost is very much higher than that of the older ones. New units must be given the benefit of lower excise duty and other tax rebates in order to be able to compete with the older units. As much as one of the big inhibitors is the public financial institutions, their interest will also be secured through this kind of approach.

Having said this, it will be unrealistic on my part not to see the brighter side of the picture. The strides we are making on the oil front will certainly generate new confidence. The improvement in the agricultural production and better industrial relations have their own points. After the declaration of the Emergency and the announcement of the 20-point programme, there is considerable improvement in the decision-making processes at the level of Governments. In all, in this context if the demand is revived through fiscal and monetary measures on the lines I have indicated, our economy which has come out of the woods in many respects in 1975 can move forward with great speed and strength in the coming year.

It is on this note I wish to conclude my speech and I am adding that the shareholders and the management owe much to our employees in our factories and offices for the contribution they have made to keep the wheels moving in difficult times. I have no doubt that the interests of your company will continue to be promoted by them.

Thank you.

Note: This does not purport to be a report of the proceedings of the Annual General Meeting.

THE MYSORE PAPER MILLS LIMITED

BANGALORE — 560 006

Chairman and Managing Director, Shri Zafar Saifullah's Speech

SPEECH delivered by Shri Zafar Saifullah, I.A.S., Chairman and Managing Director, The Mysore Paper Mills Limited, Bangalore, at the Fortieth Annual General Meeting of the Company held on Monday the 29th December 1975 in the New Hall of The Nandi Hotels (P) Limited, 5, Sampangi Tank Road, Bangalore.

LADIES AND GENTLEMEN,

It is with great pleasure that I welcome you all to this 40th Annual General Meeting of your Company. The Report of the Directors and the Audited Accounts of your Company for the year ended 31st March 1975 have been with you for some time and, with your permission I shall take them as read.

In my address to you last year, I had dwelt at some length on the serious economic situation then prevailing and of the uncertainties which we faced on the Industrial scene. However, even then, I had mentioned that one factor relieved the otherwise disheartening situation, namely, the clearly discernible will of Government to take bold and effective measures to deal with the situation.

Subsequent events have confirmed that we have been completely right in reposing confidence in the capacity of the Government under the inspiration and leadership of our Prime Minister to take steps to deal with the crisis and to enable the country to surmount its problems. The declaration of emergency on June 26, 1975 was just such a bold step which, at one stroke, arrested the declining standards of discipline and of the will to contribute

one's own effort to the larger task of helping the nation. All of you I am sure will join me in confirming that this step has been brilliantly successful and has ushered in a new era in our national life in which, after a long time, we see once again, the willingness and desire to sink individual ambitions into larger goals and aspirations.

I am glad that for our part, our Mills can take great pride in having done whatever it could in this great national endeavour. We have co-operated and gone along with all policies of Government were it be in the field of Industrial production, our marketing, our pricing, our generation of growth and fresh investments. I wish to take this opportunity to rededicate our Mills to the fulfilling of national purposes and socio-economic objectives and to confirm and reiterate our determination to set exemplary standards of conduct and performance in the Paper industry. We renew our faith in the leadership of our Prime Minister and our commitment to the fulfilment of the 20 Point Economic Programme announced by her and to make our own humble contribution towards its fulfilment. In turn, we hope Government will continue its determined thrust on anti-inflationary measures on the one hand and, on the other, imaginative steps to promote industrial investment and growth. No country, especially one in the throes of development can afford any spell of economic or industrial stagnation and concealed costs of such stagnation to the economy are virtually impossible to bear. We shall be right in feeling that our Government is fully

conscious of this and is fully capable of imaginative corrective steps.

In my address last year to you, I made a brief mention of the Expansion Programme on which we had initiated work and for which we had received a Letter of Intent to raise our capacity to 70,000 tonnes per annum. Since then, Government of India have been pleased to issue an Industrial Licence to us covering this Expansion. You will recall that I had mentioned that the basic element of the Expansion was the installation of a new 100 tonnes per day paper making machine with attendant chipping and pulping capacities and the required auxiliaries, utilities and off-site facilities. It was our strategy to use the Mills concealed capacities in these utilities, to help augment the Capacity of our existing 3 machines to produce between them, 37,000 tonnes, the total programme being phased in such a manner as to achieve each year higher levels of installed capacities and, consequently of production. You are aware that immediately after the last meeting, our Mills were called upon to face a spate of litigation which included restraints on our functioning, clamped at the instance of those who had initiated the Court Proceedings. Your Board was prevented from Meeting for nearly 6 months. This led to inevitable delay in the execution of our programmes but I am glad to say that we have been able to overcome these obstacles with your blessings, good-wishes and support and to restrict the damage of delay to the Company to the unavoidable minimum. Substantial progress has been record-

ed in the placing of order and their procurement and as also in the execution of civil works connected therewith. Perhaps the most significant development, in this context has been the suggestion to us by the Central Government to explore the possibility of manufacture of Newsprint as part of our Expansion scheme. This reflects a certain confidence on the part of the Government of India in the performance and capabilities of our Mills and, coming as it did with assurance of full support from the Government of India, we took up the proposition with all seriousness and had it studied by our Consultants, Messrs Bhargava Consulting and Design Engineers Limited, in some depth. I am glad to say that their investigations, have established the techno-economic viability and financial soundness of the Newsprint Project. The estimated total cost of the Expansion is about Rs 73 crores including an Import Content of Rs 19 crores, which will give us a newsprint manufacturing capacity of 75,000 tonnes per annum inclusive of 15,000 tonnes of magazine printing variety. The Optimisation Scheme covering the existing 3 machines remains intact, expanding them to a capacity of 37,000 tonnes availing, as earlier contemplated, the concealed and reserve capacity of the utilities etc, for the Newsprint. We have carefully considered the implications of this Project vis-a-vis the earlier proposal to expand to 70,000 tonnes of writing and printing paper. The newsprint proposal, gives a better investment turnover ratio, better generation of internal resources, better accretion of net worth of your shares, a better return on investment largely on account of better tax reliefs, better utilisation of scarce forest produce resulting from better recoveries through advance pulping and newsprint making technology and equipment designs higher national priority

easier, more stable and consistent marketing prospects, all of which holds out the prospect of a more favourable debt equity ratio being acceptable to the public financial institutions, we have decided to modify the Expansion Proposal. I am happy to inform you that necessary applications have been made for a Letter of Intent, retaining the Option to revert to the earlier scheme of expansion to 70,000 tonnes in the face of any unforeseen contingency forcing us to give up the Newsprint proposal. We have also filed our applications for financial assistance with the all-India Public Financial Institutions and with international financing agencies from all of whom we have received encouraging initial responses. We are actively pursuing the expansion scheme and I wish to assure you that we shall spare no effort to quickly realise the aspirations of our Mills and of all those who have reposed faith and confidence in our capabilities.

With the serious set-back to our functioning resulting from the series of litigations to which I have referred earlier, we had to face delays in various manners. Our plans for the expansion got interrupted rather abruptly. We reached a situation where we had to look for some immediate financial assistance to help over-come the result. At delays in proceeding with the Public Financial Institutions. Government of Karnataka has always displayed the closest consideration and concern for safeguarding our interest and, in the face of these difficulties, we turned to them for a term loan of Rs 100 lakhs. I am pleased to inform you that the State Government after studying our requirements, readily extended the financial assistance sought from them, and in June 1975 we were able to draw this entire amount. The loan has been secured at a very attractive rate of 9 per cent annum with repayment

in ten equal annual instalments commencing from the 1st January, 1979. I have also to inform you that in accordance with the practice set out by the Government of India in their guidelines to the Public Financial Institutions for loans exceeding Rs 50 lakhs, the Government retained the right to convert Rs 40 lakhs of the loan into equity at any time within the first five years. The Government has since exercised its option, and, pursuant thereto with the approval of the controller of Capital Issues 2,50,000 shares by issue of fresh capital and 16,666 shares by re-issue of forfeited shares aggregating in all 2,66,666 equity shares have been issued on August 21, 1975 at a price of Rs 15 per share as approved by the Controller of Capital Issues.

I look back with pride at the outstanding performance of your Company during the year 1974-75, justifying the confidence I expressed in my last address to you. Despite adverse socio-economic conditions all-round, your Company was able to achieve a record production of 26,000 tonnes—2,000 tonnes more than its installed capacity. This was a record performance—an increase by about 16 per cent over the preceding year.

The accounts for the year under review reveal that turnover inclusive of excise duty increased to Rs 836 lakhs as against Rs 585 lakhs in the previous year—an increase of 43 per cent and gross profit by over 38 per cent from Rs 76 lakhs to Rs 119 lakhs. After providing for depreciation of Rs 38.92 lakhs as against Rs 37.49 lakhs in the previous year and development rebate (reserve) of Rs 2.87 lakhs (as against Rs 2.5 lakhs in the previous year) and the net profit after charging Rs 30.14 lakhs towards premium on Group Gratuity Life Assurance Scheme covering all employees of the Company but before taxation works out to Rs 77.30 lakhs compar-

ed to last year's Rs 36.09 lakhs.

Your Directors have carefully considered the quantum of dividend to recommend to you. Despite our record performance and improved working results the constraints brought about by the Companies (Temporary Restrictions on Dividend) Ordinance 1974, the need to conserve resources with a view to generate better future prospects and the desire to maintain an even return on the equity base of the Company year in and year out have led your Directors to recommend a total dividend of 10 per cent (inclusive of an interim dividend of 8 per cent). I am sure that the shareholders interested as they have always been in the stability of their dividends and the long term appreciation of the value of their investments will regard the dividend declared this year as appropriate.

During the year 1974-75, there was an acute scarcity of all varieties of papers and little difficulty was experienced in disposing off the papers produced by our Mills. However, since April this year, with the recessionary trends which have emerged in the economy, the shortage in paper and the attendant black market have disappeared. The present situation is one of reduced demand for paper with the result, huge stocks are lying in all paper Mills. However, it is hoped that with the liberalisation in the use of papers for calendars etc, and with the increase in the seasonal requirement of papers for printing books etc, there should be a reasonable improvement in the coming months. I hope that our consumers whose interest we have so faithfully served when supplies were scarce, will continue to give preference to our products. As conditions of a buyers' market have set in, your Company has evolved a new Sales policy enabling direct

consumers and dealers plan their indents and patches leading to a systematic programme of utilisation and off-take.

You will notice that at the end of the financial year under report, secured loans have come down to Rs 66 lakhs from Rs 93.06 lakhs while reserves have gone up from Rs 226.05 lakhs to Rs 228.73 lakhs. The equity debt ratio has come down further from 1:0.26 to 1:0. There is thus a significant improvement in the financial soundness of your Mills.

Before I conclude, I must place on record my sincere gratitude to my colleagues on the Board for their unstinted support and valuable guidance extended to me in the proper discharge of my duties.

I should also express my sincere thanks to the Government of India and to the Government of Karnataka who have extended invaluable support and encouragement which have been the source of great strength for the Mills. I am sure that your Mills will continue to receive this support from the Governments in even greater measure in the years ahead.

I am also pleased to record our gratitude to the various Banks and financial institutions whose support for our activities continues to be spontaneous and unflinching.

I am sure you will all join me in acknowledging the sincere and outstanding work of the labour and of the officers of your Mills which was the important factor that contributed to the record performance of your Mills in the year under report. I have no doubt that we will continue to receive from them also the same measure of loyalty, hard-work and initiative with which no challenge will be too big to face.

Note: This does not purport to be a report of the proceedings of the Shareholders' meeting, a copy of which shall be sent to the shareholders separately.

THE WEST COAST PAPER MILLS LIMITED

DANDELI

Chairman Shri N. D. Bangur's Speech

SPEECH of Shri Narsing Dass Bangur, Chairman, West Coast Paper Mills Ltd., delivered by Shri P. D. Bangur at the 20th Annual General Meeting of the Company held on 30th December 1975 at Bangur Nagar, Dandeli, Karnataka.

MEMBERS AND GENTLEMEN:

I welcome you all to the twentieth Annual General Meeting of the Company. The audited accounts together with the Directors' Report have been in your hands and with your permission, I take the same as read.

Shri Gobind Lall Bangur, founder Chairman retired after an association of little over two decades with this company. His advice and guidance has been a source of great inspiration as is evident from the growth, your company has achieved. I am sure, you, as Shareholders of the Company, would like to join me in placing on record our highest sense of appreciation for his services. I have another pleasant task to perform to convey sincere thanks from Ex-Chairman for your support and co-operation in accelerating the progress of the Company.

It is needless to dwell at length on positive effect of emergency which has inculcated a sense of discipline amongst the masses and made them realise their duty towards the country. The timely action by the Government under the able leadership of our beloved Prime Minister has brought in realism and focussed attention towards speedy solution of the economic problems. The improvement in agricultural production and the growth rate in industry is better compared to the earlier years resulting in price stabilisation. The consumer has not

been able to reap the full benefit and I hope the Government would evolve a proper solution for the same.

The recommendations of the Tandon Committee suggesting norms have been accepted by Reserve Bank of India. I hope, the Bankers will take a pragmatic view in implementing the recommendations keeping in view the difficulties faced by the Industry and proceed cautiously not to affect adversely the Industrial growth.

Industry

The Paper Industry is no exception to the present recession. The stock of paper with the Mills is on increase and the demand is slack. In order to tide over the present crisis, it is suggested that the Paper (Control of Production) Order, 1974 be immediately lifted and reviewed subsequently, if necessary, in light of the experience gained. A reasonable reduction in Excise Duty be considered in the next budget to augment Paper consumption. The curbs on Export of different varieties of Paper should not only be removed but incentive be granted to help export of Paper.

Working

It is first time since we started production in 1958 that I am reporting lower production at 44,879 tonnes compared with the previous year which is mainly due to change in production pattern and partly attributable to the inadequate power supply. The manufacturing cost continues to rise. The working results for the year judged in the light of the said factors can be considered satisfactory. The production during the first five months of the

current year is slightly better.

Year after year your attention has been drawn as to the difficult Raw material supply position. We are forced to get our supplies by procurement from other States which would have due effect on the working of the current year.

Steps have also been taken to augment the supply of Raw material by increasing the consumption of hardwoods.

I would like to avail of this opportunity to request the State Government for supply of adequate power to operate the expanded capacity at optimum level. The Paper Industry is capital intensive and if full utilisation

of installed capacity is not ensured it would have its far fetched effects. It is my earnest submission, therefore, that the Industry be granted power on priority basis to full extent.

Shri B. G. Bangur was appointed as additional Director on 25th July and holds office till this meeting. A resolution is placed before you for his appointment.

Shri S. H. Khan has been appointed as Director (nominee of Industrial Development Bank of India) of the Company with effect from 2nd December 1975. I welcome Shri Khan.

I am thankful to my colleagues on the Board, Financial Institutions and Bankers for their co-operation and assistance. Thanks are also due to labour and staff at all levels for their co-operation.

Note: *This does not purport to be a record of the proceedings of the Annual General Meeting of the Company.*

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- Manufactures basically the two important anti-TB drugs—PAS and ISONIAZID—from processes developed by Pfizer scientists in India. ●
- First in India to manufacture basically Protein Hydrolysate (a pre-digested high protein preparation). ●
- By undertaking the basic manufacture of a number of important drugs, Pfizer has saved the country several crores of rupees in terms of foreign exchange. ●

- Valuable contribution to the development of scientific technology in India—Indian technicians are continually trained at Pfizer's international plants and laboratories. ●
- No remittance abroad towards royalty or technical know-how fees and the latest technology and scientific know-how made available to Pfizer in India at no cost. ●
- Highly successful import substitution programme and saving of foreign exchange. Import content today is a negligible 1 1/4% of total sales. ●
- Foreign exchange earnings through exports exceed total dividend remittances in the past several years. ●
- Entire operations in India, including manufacture, research and quality control managed by Indians. ●



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Department of Atomic Energy

On behalf of the President of India, the Director, Directorate of Purchase and Stores, Department of Atomic Energy, Bombay, invites tenders as detailed below:

1. DPS/TAPS/PPF/109 due on 10-1-76. Supply of 20.32 cm (app) Ball valve.
2. DPS/BARC (R-5)/STC/175 due on 13-1-76. Mild Steel Plates 10 mm as per IS-226 specification in different sizes 625 MT approx.
3. DPS/HWP/ELE/592 due on 16-1-76. 1.1KV PVC×PVC GI Galvanised, Armoured Wire, Copper Conductor Control Cables in different sizes and large quantities. Qty. 8500 Mtrs.
4. DPS/HWP/PPF/428 due on 17-1-76. Supply of Pneumatic Instrument (HDPE) tubing and (brass) fittings.
5. DPS/RRC/ELE/73 due on 20-1-76. Instrument Cables of six different sizes: Qty. 22 Kms.
6. DPS/PPED/ELE/337 due on 21-1-76. Supply of 4 × 65 Watts fluorescent lighting fixtures. 124 Nos.
7. DPS/PPED/ENG/1018 due on 21-1-76. Manufacture, inspection, supply, delivery and guarantee of Zircalloy element spacers. 75 Nos.
8. DPS/BARC/R-5/ELE-8 due on 22-1-76. 4/0 AWG soft drawn annealed copper stranded electroplated conductor. 2,000 Kgs.
9. DPS/HWP/ELE/594 due on 23-1-76. 3.3 KV (E) Grade AYYFV PVC × PVC Aluminium Conductor Cables. Size: 3C × 240 Sq. mm, 500 Mtrs.
10. DPS/RRC/FAB/128 due on 23-1-76. Design, Manufacture, testing and delivery at Fast Breeder Test Reactor Site, Reactor Research Centre, Kalpakkam, Tamil Nadu of Galvanized Steel Sections required for Cable Tray Assembly.
11. DPS/BARC/FAB/99 due on 27-1-76. Preparation of fabrication drawings, fabrication and supply of M.S. Filter Canisters. 455 Nos.
12. DPS/BARC/PPF/1929 due on 27-1-76. Supply of Forged Carbon steel Orifice flanges.
13. DPS/RAPS/O&M/POL/40 due on 28-1-76. Supply of special type of paint and painting materials for painting of internal smooth finished concrete surfaces of Solar Evaporation Pans of Solar Evaporation Facility at Rajasthan Atomic Power Project, Kota. Total area: 1400 M².
14. DPS/BARC/EEQ/2110 due on 30-1-76. Fabrication and Supply of an Oil Immersed Power Supply Assembly. 1 No.
15. DPS/BARC/CAP/1912 due on 30-1-76. Pay loader or front end loader, diesel engine operated, capacity 600 Kg. 1 No.
16. DPS/AMD/MIA/300 due on 30-1-76. Gravity Meter. Range: 5,000 milligals Sensitivity: 0.01 milligal Direct digital readout. 1 No.
17. DDN/MAPP/MIA/78 due on 30-1-76. Multi Channel Analyser for Gamma Ray Spectrometry with Ge-Li Crystal as detector. 1 No.
18. DPS/NFC/MIA/363 due on 30-1-76. Analytical Instrument for determining Hydrogen in Uranium Oxide pellets—capable of heating the pellets upto 2000°C to work on 220 V 50 power line—1 No.
19. DPS/NFC/ENG/243 due on 2-2-76. Forged heat treated and finished machined extruding rams out of Hot Die Steel grade AISI 6F7 as per drawing and specification. 1 No. Import Licence, if necessary, will be provided by us.
20. DPS/HWP/FAB/64 due on 2-2-76. Fabrication, inspection, testing, transportation to Heavy Water Plant Site, Kota of Distillation Unit Tanks. 3 Nos.
21. DPS/RRC/CAP/180 due on 2-2-76. A two high/four high combination instrumented laboratory rolling mill, work rolls ranging from 6.5 cm to 7.5 cm dia. (approximate) 1 No.
22. DPS/NAPP-PPED/ENG/25 due on 3-2-76. To manufacture, inspection, testing, export packing and supply of Balanced Shaft Seals and Spares "John Crane" Model or equivalent. 22 Nos. Import licence, if necessary, will be provided by us.
23. DPS/BARC/R-5/PPF/103 due on 9-2-76. Supply of seamless stainless steel tubes. 45,000 Mtrs.
24. DPS/PPED/MIA/365 due on 10-2-76. Design, manufacture, assembly, inspection, testing, delivery and guarantee of Edgewise Indicating and indicating alarm meter with current signal ranges. 412 Nos.
25. DPS/RRC/ENG/129 due on 10-2-76. Pressure equalisation and hydraulic system for material airlock. 1 Unit.
26. DPS/PPED/EEQ/191 due on 12-2-76. Supply of Field Control Panels.

Tender documents priced Rs. 5 each for items 1, 7, 15, 16, 19 and 22; Rs. 10 each for items 2, 12, 18 and 21; Rs. 15 for item 17; Rs. 25 each for items 4, 6, 8, 13, 14, 20, 25; Rs. 50 each for items 5, 9, 11, 24 and 26; Rs. 75 for item 3; and Rs. 100 each for items 10 and 23 and General conditions of contracts priced 50 P each for items 1 to 9, 12 to 19, 21 to 26 can be had from the Finance and Accounts Officer, Department of Atomic Energy, Directorate of Purchase and Stores, 3rd Floor, Mohatta Building, Palton Road, Bombay-400 001 between 10 a.m. and 1 p.m. on working days except on Saturdays. Import Licence will be provided only if items at S. Nos. 1, 4, 7, 12, 15 to 18, 21, 23 to 25 are not available indigenously. Tenders will be received upto 3 p.m. on the due date shown above and will be opened at 4 p.m. on the same day. The right is reserved to accept or reject lowest or any tenders in part or full without assigning any reasons.

Annual reviews

STATE OF THE ECONOMY

India: A rare year of price stability

by COMMERCE RESEARCH BUREAU

FOLLOWING closely on the heels of the peaceful atomic explosion last year, India launched its first satellite 'Aryabhata' into space on April 19, 1975 from a launching pad in the Soviet Union. With this venture, India entered the space age and became the 11th country of the world to send up a satellite into space.

Another heartening news of the year under review was the commencement of the flow of crude oil produced at Bombay High to Bombay refineries for test refining. On the basis of a 20-year depletion period, in due course, we would be able to get 10 million tonnes of oil a year from Bombay High, in addition to 8 million tonnes of crude which we are getting at present from our on-shore wells. Thus, after a 15-year period of pessimism as regards the new oil find, we enter the second phase which seems to be promising.

Overshadowing all these was the significant success achieved on the price front. Up to September 1974, the economy was in the grip of inflation. Prices were shooting up at a pace unprecedented in the history of independent India: In September 1974, the wholesale price index (average) was ruling about 31 per cent above its level a year ago. Faced with this dangerous situation, the Government initiated a series of monetary, fiscal and administrative measures in July 1974 and thereafter.

Once the inflationary trend was effectively stopped, we had the phenomenon of speculation-in-reverse: there was heavy unloading of hoarded stocks. As a result, prices started declining around the last week of September 1974. This decline continues till date more or less steadily. Today wholesale prices are ruling 6.5 per cent below their level a year ago. This current mild down-trend is basically a partial corrective for the speculative price rise (i.e. larger than what can be sustained by the basic balance of supply and demand) in the pre-September 1974 period.

And now a few words about the consumer price index, which is a better index of the price movement for the following reasons:

(i) Unlike the wholesale price index which covers only commodities, the consumer price index covers many of the services also.

(ii) The consumer price index reflects the prices at the retail level rather than at the wholesale level.

(iii) Compared to the wholesale price index, the consumer price index has a much more valid weighting diagram.

So, in particular, when the wholesale price index and the consumer price index show different trends, the latter index should be taken to reflect the true situation.

At 316, the all-India consumer price index number for October 1975 was lower by 5.7 per cent as compared to the peak level of 335 reached in October 1974 (see the chart alongside). Thus, the decline in prices which was confined earlier to the wholesale level has now percolated to the retail level also. During the last six years or so, it is for the first time that during recent months

(September and October) consumer prices have shown such a decline over a 12-month period on a point-to-point basis.

For the first time, the average for the 12 months ended September and October 1975 declined as compared to that for the corresponding period of 1974. This will considerably ease the pressure on the Government finances. For, the D.A. to its employees is linked to this average.

This impressive achievement on the price front is all the more remarkable when viewed in the context of the fact that most non-communist countries continue to record severe inflation during the latest 12 months (e.g. UK: 28 per cent; Italy: 13 per cent; Sweden: 11 per cent; Japan: 11 per cent and Canada: 11 per cent).

Sector-wise developments and prospects in brief are reviewed in the following paragraphs.

Agriculture

While no official data on agricultural production for 1975-76 are available as yet, according to the estimates prepared by our Bureau, agricultural production during this year is likely to record a rise of about 9 per cent as against the moderate target of 3.9 per cent per annum during the Fifth Plan. This achievement of ours on the farm front is in part a recovery from the setback we suffered in 1974-75 when agri-

Table I : Indian economy : Key indicators

(Percentage variations over the preceding year)

	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76 (likely)	Annual growth rate (%) since 1968-69	Draft Fifth Plan target (% per annum)
Real national income ..	4.9	1.4	-0.9	3.1	2.0	7.0	3.3	5.5
Real per capita income ..	2.5	-1.0	-3.2	0.8	-0.2	4.7	1.0	3.5
Agricultural production ..	7.3	-0.4	-7.9	9.5	-0.4	8.7	3.2	3.9
Foodgrains production ..	8.4	-2.8	-7.6	7.2	-0.4	10.6	2.9	4.2
Industrial production ..	3.7	4.6	5.0	1.0	3.5	6.0	4.4	8.0
Power generation ..	8.6	8.2	5.3	1.6	7.4	12.0	8.1	10.8
Money supply ..	11.8	14.0	15.7	15.2	6.3	—	12.2	—
Wholesale prices ..	2.8	6.5	13.6	30.2	7.7	—	10.9	—
Exports ..	8.6	4.8	22.5	28.0	30.9	15.0	15.8	7.6
Imports ..	3.3	11.6	2.4	58.3	51.2	18.6	15.7	3.6

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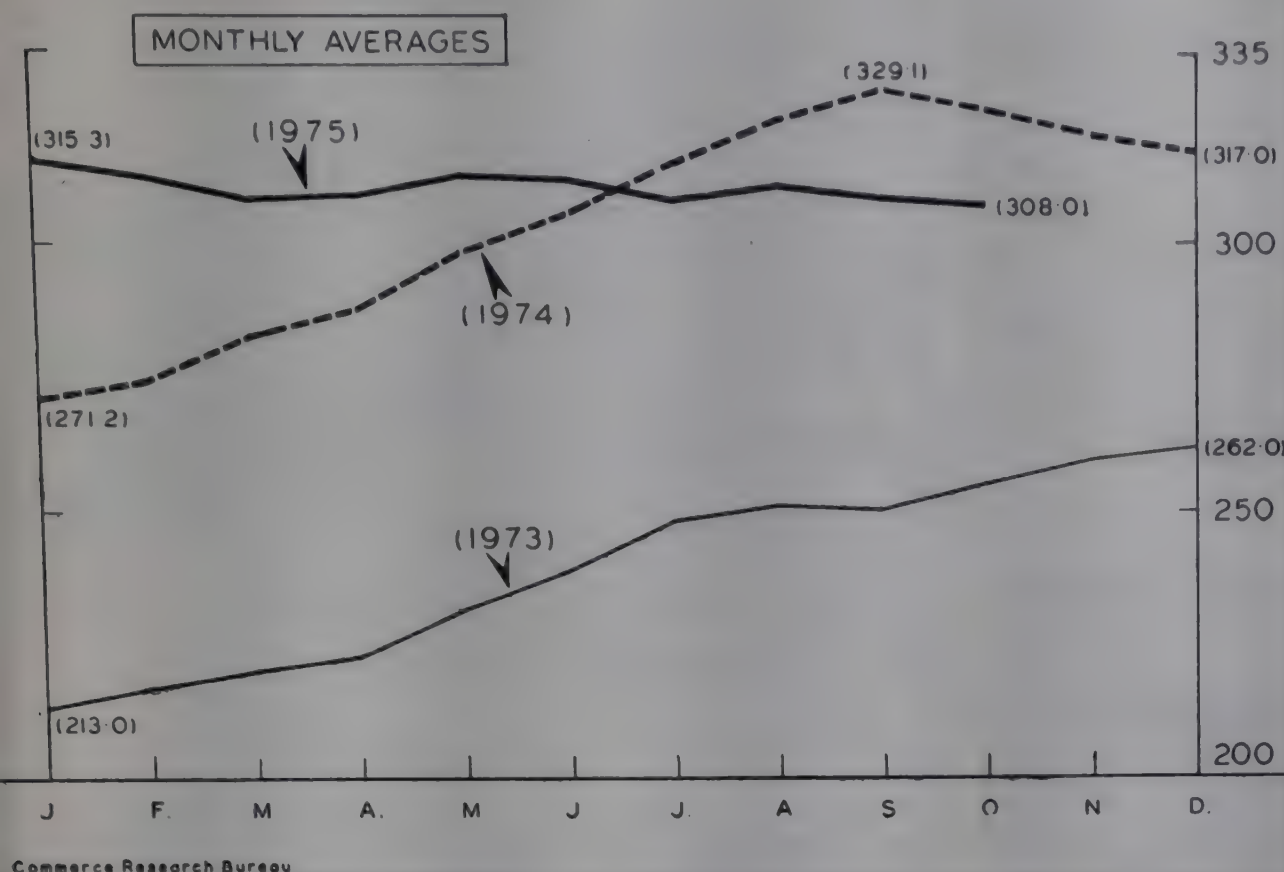
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cultural production had marginally declined. The major factors responsible for the improved agricultural production are: excellent south-west monsoon, easy and timely availability of inputs like better quality seeds, fertilisers, water, power, pesticides etc.

In table 1 we set out the key indicators of the Indian economy during recent years.

In the course of the year under review, the following major steps were taken to step up the agricultural production:

(a) With a view to boosting the demand for fertilisers, within less than six months, two downward revisions in the price of fertilisers were effected; (b) priority was accorded to the completion of on-going irrigation projects under Mrs Indira Gandhi's 20-point economic programme; (c) the area under high-yielding varieties was stepped up considerably; (d) new varieties of rice, jowar and bajra were developed at ICAR and other research institutions; (e) State governments were directed to bring in tenancy legislation in line with the national policy and to implement land ceiling laws.

As this is being written in the third week of December, the harvesting of kharif crops has been in full swing throughout the country. This is also reflected in the heavy market arrivals of foodgrains. Particularly in Punjab and Haryana, as a result of sustained supplies, open market prices of maize and

paddy had fallen below the procurement prices. In order to ensure that the growers of these crops do not suffer any losses, the Central government had directed the Food Corporation of India and the State governments to make requisite purchases at procurement prices in order to provide proper price support.

Following the record improvement in the supply position of foodgrains, the pressure on the public distribution system has considerably eased. Thus, e.g. the offtake from the public distribution system had dropped from 10 lakh tonnes in October to only 6 lakh tonnes in November. Procurement of kharif rice also has gathered momentum, and at this rate it is likely to exceed the procurement target of 4.6 million tonnes fixed for 1975-76.

The country has already bagged the record kharif harvest of about 70 million tonnes. Thanks mainly to the late rains in September and October and the resulting sub-soil moisture, prospects for the rabi crop are also promising. With the expected rabi production of about 45 million tonnes, the country looks forward to the highest ever foodgrains production of about 115 million tonnes during 1975-76 against 104 million tonnes in the preceding year.

Notwithstanding this record domestic production, the government proposes to import about 5 million tonnes of foodgrains during the coming year. The purpose is to build up a sizable buffer-

ANNUAL REVIEWS

stock and ensure price stability in the event of the failure of monsoon. For, Indian agriculture is still at the mercy of vagaries of monsoon.

Barring jute, prospects for other cash crops such as cotton, oilseeds, sugar and rubber are also very bright.

Industrial production

Industrial production increased just by 1.0 per cent in 1973-74: it was a year of stagnation. With a marginal improvement in 1974-75, it seems to have increased by about 3½ per cent. The official indices of industrial production for post-September 1974 months are not yet available. But, according to the estimates prepared by the Commerce Research Bureau, industrial production seems to have increased by 4.8 per cent during January-October 1975, compared to the corresponding months of 1974.

The relevant data are presented in Table 2 below.

Table 2: Trends in industrial production (Base : 1960=100)

Year/month	Index	Percentage variation over corresponding period in the preceding year
1970-71	181.3	3.7
1971-72	189.6	4.6
1972-73	199.0	5.0
1973-74	201.0	1.0
1974-75	208.0	3.5
January-October (Base: 1970=100)		
1974	115.6	1.6
1975	121.1	4.8

Among the industries which recorded a rise of 5 per cent or more during the first ten months of 1975 were: electricity, steel, sugar, cement, soda ash, vanaspati, aluminium and copper. Industries which recorded a decline of 5 per cent or more during this period were: all automobiles taken together.

The major factors contributing to the increase in industrial production are: improved power situation, comfortable supply of industrial raw materials, removal of transport bottlenecks and better movement of goods on railways. Besides, following the declaration of Emergency, there has been a dramatic improvement in the labour situation. All these together led, in turn, to

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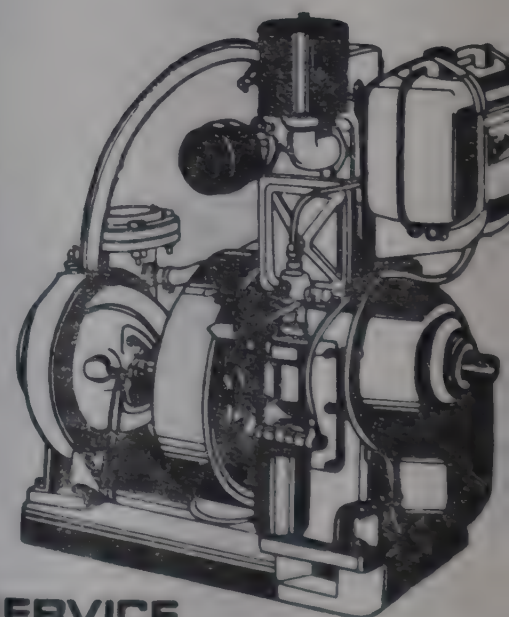
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capacity utilisation in a wide range of industries.

Following the improvement in coal supplies to thermal power stations, good rains in the catchment areas of hydel reservoirs, coupled with the addition to installed capacity, there has been a sharp improvement in the power supply position.

As a result, in many States the restrictions imposed on power consumption had been totally removed, and in many others, they had been relaxed to a considerable extent. In particular, the States of Maharashtra, Gujarat, Tamil Nadu and West Bengal, which account for about 60 per cent of the power added in the manufacturing sector, the power situation has improved considerably.

Table 3: Supply position of some key inputs

	Unit	January-October		Percentage increase
		1974	1975	
Production (a)	Million tonnes	61.6	71.1	15.4
Crude steel	Million tonnes	3.8	4.4	15.8
Integrated steel plants only)	Million tonnes			
Power generation	Billion kwh	56.1	61.9	10.3

(a) Refers to January-September

Only a few months ago, the industrial scene was dominated by a series of shortages, and in some cases the items were just not available at any price whatsoever. The position has dramatically changed today. Currently, surpluses rather than shortages dominate the scene. Specific mention may be made of coal, steel, aluminium, copper and automobile tyres. Heavy discount rather than the premium is the order of the day.

After the proclamation of Emergency, every effort is being made to improve the labour-management relations and thereby raise production—especially that of items of mass consumption. During the post-Emergency period, the proportion of strikes, lock-outs and lay-offs has declined considerably. Thus, only 16,127 man-days were lost during August 1975 as against 1.36 lakhs during August 1974. This improvement in the labour situation can be expected to lead to a reasonably good increase in industrial production in coming months.

Particularly noteworthy is the sharp improvement in the production of public sector enterprises which occupy a key position in the industrial structure of India. According to the Minister for

Industries, Mr T. A. Pai, the value of the output of public sector undertakings in the first half of 1975-76 has risen by 19 per cent, while that of the units under the Ministry of Industry and Civil Supplies has gone up by 40 per cent. Even after making an allowance for some marginal increase in prices, there has been a substantial increase in physical production.

Proverbial delays in licensing have been virtually wiped out. The number of pending cases for licensing has come down substantially, from about 1,000 a year ago to fewer than 100. A series of measures has been taken to remove the procedural hurdles and improve the utilisation of capacity. Besides, a number of measures to facilitate expansion of capacity in various industries have been announced in recent months.

Recently, recessionary trends have emerged in a few industries. One can speak of a recession only in the case of cars and jeeps and a few other consumer durables like fans, TV sets and radio sets. There is a recession in the cotton textile industry and mini steel plants also. But, from these cases, it would not be valid to draw the inference that the economy as a whole is passing through a recessionary phase. On the contrary, production has been rising in every major sector of the economy. Even the rate of increase in production in recent months appears to be higher than in any other year during the past five years. Perhaps most significant is the fact that except in respect of the few recession-affected industries mentioned earlier, the increased production is more or less matched by increased domestic consumption or increase in exports (e.g. coal, power generation, cement and sugar).

National income

Subject to some limitations, the movement of real national income over a period is regarded as the best available indicator for the quick synoptic assessment of the performance of an economy.

The official CSO data on real national income are not yet available for 1975-76. However, according to the estimates prepared by the Commerce Research Bureau, the real national income during the current financial year is likely to register a rise of 7 per cent. This is the highest on record during recent years.

In recent years, aggregate real national income has been rising at the annual rate of 3.3 per cent per annum as against the Plan target of 5.5 per

ANNUAL REVIEWS

cent. As a result, the per capita real national income has been rising moderately at the rate of 1.0 per cent per annum, i.e., at well below the population growth rate of 2.2 per cent per annum during recent years.

Foreign trade

In the situation in which India finds itself, the performance of our foreign

Table 4: Trends in real national income (1960-61=100)

Year	Aggregate		Per capita	
	Index	Percentage variation	Index	Percentage variation
1970-71	143.5	4.9	115.1	2.5
1971-72	145.5	1.4	114.0	-1.0
1972-73	144.2	-0.9	110.4	-3.2
1973-74	148.7	3.1	111.3	0.8
1974-75	151.7	2.0	111.1	-0.2
1975-76	162.3	7.0	116.3	4.7

trade should be better judged by the trade balance rather than by the absolute level of exports. Thus viewed, India's foreign trade performance during 1974-75 should be regarded as disappointing. Of course, our exports increased from Rs 2,523 crores in 1973-74 to Rs 3,304 crores during 1974-75 recording the highest ever growth of 31 per cent. But at the same time our import bill shot up much faster from Rs 2,925 crores to Rs 4,468 crores or by as much as 51 per cent—against the highest ever. Of course, the big spurt in imports and exports was almost wholly due to the spurt in unit values. But the growth of our exports was more than offset by the growth of our imports. The upshot of this was that the year closed with an alarming trade deficit of Rs 1,164 crores compared to the deficit of Rs 432 crores in 1973-74 and a surplus of Rs 103 crores in 1972-73 (see Table 5). This set a new record of a trade deficit in the foreign trade history of independent India, the previous highest being Rs 949 crores way back in 1965-66.

If the first six months of 1975-76 (April-September) are any guide, we may end up the current fiscal year with exports worth Rs 3,800 crores and imports worth Rs 5,300 crores. As a result, we may have to face a staggering trade deficit of about Rs 1,500 crores—the highest ever in the history of India's foreign trade.

Notwithstanding the considerable strain on our balance of payments,

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Table 5 : India's foreign trade

(Rs crores)

Year	Imports		Exports		Trade balance
	Amount	Percentage variation	Amount	Percentage variation	
1970-71	1,634	3.3	1,535	8.6	— 99
1971-72	1,824	11.6	1,608	4.8	— 216
1972-73	1,868	2.4	1,971	22.6	+ 103
1973-74	2,955	58.3	2,523	28.0	— 432
1974-75	4,468	51.2	3,304	31.0	— 1,164
April-September					
1974	1,933		1,515		— 418
1975	2,361	22.1	1,732	14.3	— 629

foreign exchange reserves (excluding gold) increased by Rs 199 crores—from Rs 787 crores at the end of March 1975 to Rs 986 crores at the end of September 1975.

The sharp increase in foreign exchange reserves may be attributed to the following factors:

(a) Increase in the exchange earnings from invisibles like remittances from Indians abroad. This was mainly due to the crackdown on smugglers and foreign exchange racketeers and the resultant disappearance of the black market premium on hard currencies like the dollar and the pound sterling.

(b) The drive of the Finance Ministry to attract funds from Indians abroad and aliens of Indian origin.

(c) Tourists seem to have been changing their hard currencies with banks rather than with black marketeers. Thus, net earnings from invisibles have provided an invaluable support to the balance of payments and also helped augment our foreign exchange reserves.

In addition, India has already drawn a little over Rs 200 crores from the International Monetary Fund (IMF) under the 1975 oil facility. This also has boosted our reserves.

The world: Economy slows down

by COMMERCE RESEARCH BUREAU

THE slump in world economy which started in the closing months of 1973 became deeper and more pervasive in 1974. Overall GNP of the non-communist world grew by a meagre two per cent in 1974, which was well below the annual averages of the order of four-five per cent achieved over the previous 20 years. In the six leading countries—the USA, the UK, West Germany, Japan, France and Italy—which account for 80 per cent of the combined GNP of the advanced nations and more than half of the world total industrial production declined sharply. The crises in energy and agriculture aggravated inflationary pressures and disrupted the balance of payments equilibria in many countries.

The slump in Japan in particular constituted a sharp reversal from the average post-war growth rate of nearly 10 per cent. It also was the first decline in real GNP of Japan since the Second World War. Much of the West German industry is working at three-

fourths of capacity; exports are sagging. Unemployment has been kept at a low rate of five per cent by the departure of half a million foreign workers.

The UK has a very high rate of inflation, its industrial output is almost at the level of early 1974 three-day week period. Italy is still in a fragile economic state and production is down by 12 per cent since 1974 and inflation is running at 15 per cent yearly. France expects in 1975 its first negative growth rate since the Second World War. The number one problem for France is 1.5 million jobless, though the trade balance has, of late, shown a spectacular improvement.

A widespread impression to the contrary notwithstanding, the recession is not a world-wide phenomenon. The communist countries continued to register fairly satisfactory growth although at a rate slightly lower than usual. The boom in the oil-exporting countries also continued although the

ANNUAL REVIEWS

strength of this boom was not as staggering as was forecast in 1974.

Turning to developing countries, those which rely heavily on exports of some raw materials suffered heavily as the prices of these materials came down tumbling. On the other hand, other developing countries were, by and large, free from recession.

Broadly, it appears that about half of the world—in terms of population or GNP—is caught in recession while the other half is free from it.

Recessionary trends

The depth of the recession in the developed non-communist countries can be measured by the fact that in July 1975 the OECD reported that GNP of the USA was about 13 per cent lower than what would have been expected on the basis of past trends. The combined GNP of the 24 leading non-communist countries was 10 per cent below the long-term trend.

Above 80 million dwt (14.5 per cent) of shipping throughout the world is idle because of the economic slump. A number of shipyards in the world are either idle or have large surplus capacities. The slump is more pronounced in the categories of bulk carriers which are not in demand. With the decline of 9.4 million GRT in the third quarter of 1975, the world ship-building order book position was brought down to 93 million GRT as on September-end 1975. This was the lowest level since 1972-end.

According to the latest data released by the International Labour Organisation (November 1975), combined unemployment in leading western industrialised countries stood at more than 17 million at the end of September 1975.

Steel production of the members of the International Iron and Steel Institute which accounts for roughly two-thirds of the world's steel output, is likely to be 15 per cent lower in 1975. As against an original expectation of 750 million tonnes of world steel production in 1975, it may actually turn out to be only 655 million tonnes. Steel production was 700 million tonnes in 1974. Western Europe expects a 20 per cent fall in steel production followed by Japan and the USA which both expect a decline of 16 per cent each in 1975.

The recent economic summit of the six leading industrialised nations held



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— SMT. INDIRA GANDHI



OIL & NATURAL GAS COMMISSION

Cambouillet near Paris (November 1974)—France, the USA, the UK, West Germany, Japan, and Italy—was mainly concerned with the co-ordination of economic recovery policies of the participating countries in the context of the fact that industrialised nations have not shaken off their worst and deepest post-world war recession. No success in this matter has, however, been reported.

Industrialised societies are caught in a dilemma. If they take energetic steps to revive economic activity, they evoke a new resurgence of inflation. On the other hand, the steps they take to curb inflation prolong the recession which threatens to become chronic.

Inflation

During recent years, we have witnessed a steady and breath-taking acceleration of prices in the non-communist countries of the world. So, expectedly, every country has launched a vigorous drive against inflation. Not all the countries have, however, succeeded in this drive.

From an annual average of 3.9 per cent during the decade 1963-72, the rate of inflation in industrialised countries rose to 7.7 per cent in 1973, 13.2 per cent in 1974. The annual rate of inflation in these countries over the year ended September 1975 slowed down to 10.4 per cent.

During the latest year ended September 1975, the UK had the highest inflation rate of 26.6 per cent as compared with 16 per cent in 1974. Countries which have succeeded in bringing down the rate of inflation are: the USA from 11 per cent in 1974 to 7.8 per cent over the year ended September 1975, Japan from 24.5 per cent to 10.7 per cent, France from 13.7 per cent to 11 per cent and West Germany from 7 per cent to 6.1 per cent. Italy, however, reduced its inflation from 19.1 per cent to 15.1 per cent during the above period—the second highest among industrialised countries.

The question of achieving price stability in these countries has become more or less an academic issue and is not expected to be achieved in most of these countries in the foreseeable future.

Trade

The General Agreement on Tariffs and Trade (GATT) reported an increase of 47 per cent in dollar terms in world exports in 1974 over 1973 as compared with 38 per cent rise in 1973 over 1972.

However, in volume terms, exports fell from 11 per cent in 1973 over the previous year to about 6 per cent in 1974 over 1973—an unprecedented decline since the Second World War.

The value of imports in dollar terms of industrialised countries increased by 45 per cent and of exports by 34 per cent in 1974 over the preceding year. In real terms, the imports of these countries increased by only 1.5 per cent but exports increased by 7.5 per cent.

Chiefly owing to the oil price increase, the value of exports of developing countries doubled and their share increased from 19 per cent in 1973 to 27 per cent in 1974, exports of the oil exporting countries to the developed areas increased by a fabulous 220 per cent in value, but declined in volume by 4 per cent in 1974 over 1973. The oil exporters' share in world trade expanded from 7 per cent in 1973 to 16 per cent in 1974. Trade of East European countries (both exports and imports taken together) increased by 30 per cent in value terms in 1974 over the preceding year, and their share in world trade fell from 10 per cent in 1973 to 8 per cent in 1974.

Exports of industrial countries reached an estimated value of \$138 billion in the second quarter of 1975 as against \$133 billion in the first quarter. The imports of these countries rose from \$137 billion in the first quarter to \$139 billion in the second quarter of 1975.

As a result of the 10 per cent hike in crude oil prices from October 1, 1975, the oil importing countries will have to bear an additional burden of \$10 billion per year.

Balance of payments

The EEC's balance of payments on current account produced a \$20 billion deficit in 1974. More pronounced was the worsening deficit of the UK, Italy, France and Denmark. Among industrialised countries, the most conspicuous development was a turn of SDR 1.7 billion surplus in the first quarter of 1975 to a deficit of SDR 1.3 billion in the second quarter of 1975. It may be noted that there was a reduction in the surplus of oil producing countries from SDR 3.7 billion in the first quarter of 1975 to SDR 2.5 billion in the second quarter of 1975. This was largely due to the deficits incurred by Indonesia, Iraq and Libya.

The World Bank has estimated the cost of oil imports to the Third World at \$9.2 billion and the balance of pay-

ANNUAL REVIEWS

ments deficit of this group is estimated at \$35 billion for 1975. However, the balance of payments surplus of the OPEC nations is expected to be \$50 billion in 1975. According to the recent forecast made by the OECD, the overall deficit on balance of payments of the industrialised countries will certainly be lower than \$10 billion and could even fall to \$5 billion in 1975, as compared with the earlier forecast of \$15 billion for 1975.

IMF drawings

Drawings on the IMF during 1974 totalled SDR 4,053 million. This was the largest amount drawn in a calendar year. The previous highest was SDR 3,552 million in 1968. During the period January-September 1975, drawings on the IMF were SDR 3,695 million as compared with SDR 2,624 million over the same period of 1974.

The IMF Oil Facility was established on June 13, 1974 for a period ended December 31 1975. To finance the oil facility arrangement of 1974, the Fund borrowed SDR 3.05 billion. The Fund's oil facility was enlarged to SDR 5 billion for 1975 plus any amount unused from the 1974 Oil Facility (SDR 1.2 million).

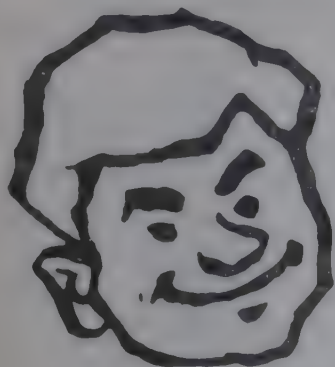
The largest purchases under the 1974 oil facility were made by Italy, India and Yugoslavia, totalling SDR 984 million.

A subsidy account has been established by the IMF to help cut interest payments the developing countries pay under the oil facility. The goal is to reduce the interest rate charged to the nations most seriously affected by the high price of oil from 7.5 per cent to 2.5 per cent. By August-end 1975, 18 countries had expressed their willingness to contribute to the subsidy account totalling SDR 149 million.

Aid to developing countries

The net flow of resources to developing countries and multilateral agencies from the OECD rose to \$26.7 billion in 1974, from \$24.3 billion in 1973.

During 1974, the OPEC committed \$16 billion for international assistance as compared to \$3 billion in 1973. Of this, about \$6.7 billion was actually disbursed. In the first six months of 1975, bilateral OPEC assistance totalled \$4,056 million. The lending operations



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the OPEC are characterised by a very bias in favour of a few nations.

The World Bank has evolved an intermediate financing facility, the so-called "Third Window", which has been approved in the first instance for one year. Under this scheme, the World Bank will grant loans to developing countries with an annual per capita income of \$200 and \$375 at a concessional interest rate midway between the World Bank loans and IDA credits. The new intermediate loans, to be raised on the international capital market, will be financed by a special interest subsidy account to which 12 nations have already agreed to contribute about 20 million (SDR 100 million). Through the "Third Window" facility, the World Bank would provide loans worth \$500 million. Interest on these loans will be subsidised out of the interest subsidy account.

The World Bank President Mr Robert McNamara, has proposed (September 1975) a massive lending programme of \$7 billion for 1975-76 and 40 billion for the 5-year period ending in 1980, to meet the capital crisis engulfing the developing countries.

At the initiative of Iran, the OPEC has agreed (November 1975) to establish a \$1-billion fund to aid developing countries hard-hit by oil prices. The aid programme is for 1976. Loans without interest will be made to finance balance of payments deficit and long-term projects. The fund will be made up of contributions by all OPEC nations at the rate of 10 cents for every barrel of crude they export. It is estimated that OPEC's oil exports will be 10.5 billion barrels in 1976. Thus, the fund would amass \$1,050 million in 1976. The feature which makes this fund-scheme specially attractive to the oil producers is that they will have far more say in its policy than they have in existing organisations such as the World Bank.

Delegates from 69 developed, developing and oil producing countries reached broad agreement in October 1975 on setting up a new \$1,200 million International Agricultural Development Fund to help the world's poorest countries feed themselves.

Prospects

With inflation still running high and recession biting deeper than anticipated in industrial countries, the search for new policy instruments to overcome structural weaknesses continues, even if without much immediate success. Referring to OECD economies, the Secretary General, Mr Emile Van Len-

nep, said (October 1975) that although all were forewarned, it did not prove possible to prevent the development of a major inflationary recession. "Mistakes of policy were no doubt made, both individually and collectively and the severity of the recession was not foreseen." While the rise in consumer prices in the OECD area has fallen back from 15 per cent a year to 10 per cent in the latest months, this rate is still unacceptably high.

At present, a perceptible up-swing in the USA is an established fact. A five to six per cent rise in the GNP in the USA in 1976 seems probable. In Japan, the recovery should continue in 1976, although at a rate well below the previous growth potential of the Japanese economy. In Europe, there are as yet few signs that the turning

AGRICULTURAL PRODUCTION : 1975-76

Sharp increase of 9 per cent expected

By COMMERCE RESEARCH BUREAU

FOLLOWING the failure of monsoon, the year 1974-75 turned out to be very bad for agriculture. Fortunately, however, between June and September 1975, the country received excellent rainfall from the south-west monsoon. Reflecting this, the country has harvested a bumper kharif crop tentatively estimated at 70 million tonnes, against about 60 million tonnes in 1974-75. But for the damage caused by floods to kharif food crops in parts of 12 States—Assam, Bihar, Gujarat, Jammu & Kashmir, Kerala, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal—the output of kharif foodgrains would have been still larger during 1975-76. The heavy rainfall in September and October 1975 left sufficient sub-soil moisture. This has helped the extensive sowings of rabi food crops during November 1975. At the time of writing this review (December 15, 1975), the prospects of rabi food crops are rated good. The output of rabi foodgrains is likely to be 45 million tonnes, against about 44 million tonnes in 1974-75. Thus, the output of foodgrains (kharif plus rabi) during 1975-76 is expected to be at a record level of 115 million tonnes, against about 104 million tonnes in 1974-75 and the previous year level of 108.4 million tonnes in 1970-71.

As can be seen from Table 1, the output of foodgrains (kharif plus rabi) during 1975-76 is expected to show an

increase of 11 per cent. Turning to the non-foodgrains group, the production is likely to go by 4 per cent in 1975-76. Overall agricultural production during 1975-76 is expected to show an impressive increase of about 9 per cent.

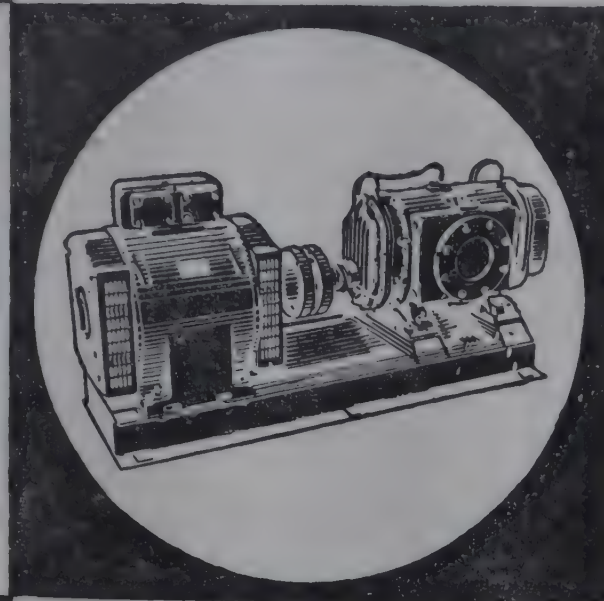
However, it may be noted that the index of overall agricultural production does not fully reflect the real increase in output as the production of some very important commodities like vegetables, fruits and milk are left out in the compilation of the index on agricultural production. The production of some of these commodities has increased substantially during the current year.

The tentative estimates of production of 38 crops for 1975-76, prepared

Table 1 : Commerce Research Bureau's estimate of agricultural production during 1974-75 and 1975-76

Group	Weight in the official index	Percentage variation over the preceding year		
		1973-74	1974-75	1975-76
Foodgrains	65.86	7.5	— 0.5	11.1
Non-foodgrains	34.14	15.4	— 0.4	4.4
All commodities	100.00	9.5	— 0.4	8.7

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'LOST' A Whole City

Though not like Atlantis or Pompeii, there was a time, not very long ago, when Calcutta was considered a lost city and a lost cause. Bursting at the seams with the pressure of population, inadequate water supply resulting in epidemics, accumulated garbage, despair and stench almost suffocating it, faith in the city was the first casualty.

No wonder, many thought Calcutta was lost. That was five years ago.

It was then that the Calcutta Metropolitan Development Authority came on the scene with a mandate from the Prime Minister to save the city.

Today, many difficulties and five years after, Calcutta is not a paradise but no longer a lost cause. It has been helped on the way to recovery and health.

What has been done? Compared

to the problems, very little. Nearly twenty arterial roads have been widened though there are few scores remaining.

Three bridges and a subway have been constructed; many more should be built before traffic moves slightly better.

Water supply has been increased by about 50 per cent through nearly 300 deep tubewells and by augmenting the capacity of the existing water works; it must be increased 100 per cent more.

Thirty five municipalities and over 100 anchals have received some attention; the process must continue.

Hospital, education and recreation facilities have been expanded; the impact is not major.

The time has, therefore, not

come when we can say that the city has been saved. We can only say that the city is not lost.

CMDA's aspirations today are not sky high; just pure drinking water for everybody in the metropolitan area, wide sewerage and drainage network to remove sewage and storm water in a scientific manner, better traffic and transportation arrangements with wide roads, more bridges, flyovers and subways, better slums (if we have to have them) with paved roads, water, electricity and sanitary latrines...In other words, just the basic amenities to start with.

Calcutta is not just a city where people live. It's a city people love.

In this city of life and love, CMDA has begun its work to help it regain its pulse and beat.



CALCUTTA METROPOLITAN DEVELOPMENT AUTHORITY

Table 2: Commerce Research Bureau's estimates of agricultural production: 1974-75 and 1975-76

Crop	Area: 1973-74		Weight In the index of agricultural production	Production (Million tonnes)			Percentage Increase in 1975-76 over 1974-75 (a)
	Million hectares	Per cent		1973-74	1974-75	1975-76	
Foodgrains	126.12	78.9	65.86	103.61	104.00	115.00	10.6
Rice	38.01	23.8	34.80	43.74	41.50	46.00	10.8
Jowar	16.96	10.6	5.87	8.99	8.50	9.00	5.9
Bajra	13.65	8.5	2.53	7.09	4.00	7.50	87.5
Maize	6.02	3.8	2.40	5.64	5.50	5.00	- 9.1
Ragi	2.39	1.5	1.34	2.13	2.10	2.00	- 4.7
Small millets	4.53	2.8	1.00	1.86	2.00	2.00	—
Wheat	19.06	11.9	8.36	22.07	27.00	30.00	11.1
Barley	2.62	1.7	1.59	2.33	2.60	2.50	- 3.8
Gram	7.69	4.8	3.85	4.01	5.00	5.00	—
Tur	2.58	1.6	1.25	1.37	1.50	1.50	—
Other pulses	12.61	7.9	2.87	4.38	4.30	4.50	4.7
Oilseeds							
Groundnut : in shell	6.90	4.3	5.40	5.93	4.99	6.50	30.2
Sesamum	2.36	1.5	0.64	0.48	0.41	0.50	22.5
Rapeseed and mustard	3.43	2.1	1.70	1.70	2.21	2.25	1.8
Linseed	1.88	1.2	0.51	0.50	0.54	0.58	6.9
Castorseed	0.53	0.3	0.12	0.23	0.22	0.25	15.6
Safflower	0.63	0.4	0.08	0.19	0.20	0.20	1.9
Nigerseed	0.49	0.3	0.10	0.14	0.13	0.14	6.7
Coconut: copra	1.10	0.7	1.81	0.85	0.89	0.86	- 3.3
Cottonseed	—	—	1.08	2.10	2.34	2.48	6.0
Fibres							
Cotton	7.60	4.8	3.27	1.07	1.20	1.24	3.2
Jute	0.79	0.5	1.34	1.12	0.81	0.77	- 4.2
Mesta	0.37	0.2	0.31	0.26	0.24	0.22	- 9.6
Sannhemp	0.14	0.1	0.12	0.05	0.06	0.05	-15.6
Plantations							
Tea	0.36	0.2	2.88	0.47	0.49	0.48	- 0.6
Coffee	0.15	0.1	0.27	0.09	0.09	0.09	—
Rubber	0.17	0.1	0.11	0.13	0.13	0.15	11.5
Condiments and Spices							
Pepper : black	0.12	0.1	0.13	0.03	0.03	0.03	—
Chillies : dry	0.73	0.5	1.51	0.50	0.45	0.50	11.0
Ginger : dry	0.02	—	0.04	0.04	0.03	0.04	16.7
Turmeric	0.07	—	0.18	0.13	0.15	0.15	—
Areacanuts	0.18	0.1	0.78	0.15	0.15	0.15	—
Fruits and vegetables							
Potatoes	0.53	0.3	1.22	4.63	5.00	5.20	4.0
Bananas	0.22	0.1	0.93	3.20	3.20	3.25	1.6
Cashewnuts	0.24	0.1	0.17	0.20	0.20	0.20	—
Miscellaneous							
Sugarcane: gur	2.72	1.7	7.79	14.43	14.31	14.50	1.3
Tobacco	0.45	0.3	1.37	0.44	0.45	0.45	—
Guarseed	1.82	1.1	0.28	0.76	0.42	0.75	77.8
Total area	160.12	100.0					
Index (b)							
Foodgrains			65.86	130.3	129.7(c)	144.1	11.11
Non-foodgrains			34.14	135.4	134.9	140.8	4.4
All commodities			100.00	132.0	131.5	143.0	8.7

NOTE : Our production estimates of kharif crops are based on our current assessment of the crop conditions and other related factors. Sowings of rabi crops have started in November. So our estimates of the production of rabi crops represent our assessment of likely production.

(a) Based on absolute data

(b) Base : Triennium ended 1961-62 = 100

(c) Although the production of foodgrains registered a small increase in 1974-75, the foodgrains production index shows a marginal fall. This is because of the fact that within the foodgrains group, there was a significant fall in the high value crops (e.g., rice) which was inadequately offset by the increase in the output of low value crops.

ANNUAL REVIEWS

by the Commerce Research Bureau, are presented in Table 2.

To put the current year's spurt in agricultural production in proper perspective, we may note that the average annual rate of agricultural production during the 7 years ended 1975-76 works out to 3.1 per cent, which is somewhat below the target envisaged by the Planning Commission.

Price policy

Following the receipt of the Agricultural Prices Commission's (APC) 'Report on Price Policy for Kharif Cereals for the 1975-76 Season', the Union Minister for Agriculture and Irrigation, Mr Jagjivan Ram, held a round of discussions with the State Chief Ministers and Food Ministers during September. On September 29, 1975, Mr Jagjivan Ram announced the government's acceptance of the recommendation of the APC to maintain the procurement prices of kharif cereals for the 1975-76 season at the preceding season's level (Table 3). This decision was taken despite strong pressure for an upward revision of procurement prices from some State Governments.

Table 3: Procurement and issue prices of kharif cereals : 1975-76

(Rs per quintal)			
Commodity	Procurement price	Issue price	
Paddy	74	86	
Jowar	74	86	
Bajra	74	86	
Maize	74	86	
Ragi	74	86	
Rice : Coarse		135	
Medium		150	
Fine		162	
Superfine		172	

Procurement

The procurement price for rice would be derived from the paddy price after taking into account qualitative differences, hulling or milling charges and other processing and incidental charges obtaining in different States. The government has decided to increase the weightage for parboiled rice from Rs 2 to Rs 3 per quintal. But there would be no change in the issue price of parboiled rice. The issue prices of rice and coarse grains would be maintained at the existing level.

ANNUAL REVIEWS

These prices were last revised upward on January 1, 1975.

For the 1974-75 marketing season (October-September), the APC has recommended the procurement target of 53 lakh tonnes of rice, but the government has scaled it down to 46.35 lakh tonnes in view of the damage caused to the paddy crop by the floods in some States (Table 4).

Table 4 : State-wise rice procurement targets for 1975-76

(Lakh tonnes)

State	Recom- mended by APC	Fixed by Govt.
Andhra Pradesh ..	10.00	10.00
Punjab	10.00	9.00
Tamil Nadu ..	6.00	5.00
Uttar Pradesh ..	5.50	5.00
Haryana	3.50	3.50
Madhya Pradesh ..	3.50	3.00
West Bengal ..	4.00	3.00
Orissa	2.25	1.75
Karnataka ..	2.00	1.50
Assam	1.30	1.30
Maharashtra ..	1.75	1.25
Kerala	0.08	0.60
Gujarat	0.50	0.50
Jammu and Kashmir ..	0.50	0.50
Bihar	1.00	0.25
Rajasthan	0.10	0.10
Others	0.30	0.10
All-India	53.00	46.35

The APC has recommended the target of 12.75 lakh tonnes for kharif coarse cereals for the 1975-76 season. However, the government has not fixed any target for coarse cereals as there are no inter-State restrictions on the movement of coarse grains. As suggested by the APC, the existing inter-State restrictions on rice movement are to continue. The existing scheme of incentive bonus for rice would be modified in such a way that while the bonus earned by a State would be linked to the supplies to the Central pool, it would be utilised primarily for providing fertilisers and other inputs to farmers at concessional rates and not for supplementing the State's general plan resources.

Between October 1 and November 21, 1975, the procurement of rice aggregated 18 lakh tonnes, against the pro-

curement target of 46.35 lakh tonnes. As usual, Punjab and Haryana led all the States in the procurement of rice. The all-India procurement target fixed for rice is expected to be achieved, although some of the States may fail to fulfil their targets. By the end of the third week of November 1975, the procurement of coarse grains was 84,000 tonnes, against only 15,000 tonnes in the corresponding period of last year.

Public distribution

Reflecting the excellent kharif crop prospects, the availability of foodgrains in the open market has improved. As a result, the offtake from the public distribution system has dropped from about 10 lakh tonnes in October 1975 to 6 lakh tonnes in November 1975. During 1975, the total issuance of foodgrains through the public distribution system is likely to be about 10 million tonnes (or even a little less), against about 11 million tonnes in 1974.

Buffer stock

According to an assessment made by the Planning Commission, the government is likely to procure about 10 million tonnes of foodgrains, mainly rice and wheat out of the 1975-76 crop. During 1975-76, the government has planned to import 5 million tonnes of foodgrains. With the estimated issuance of 10 million tonnes of foodgrains through the public distribution system during 1975, the government is expected to build a buffer stock of 5 million tonnes for rainy days.

The supply and demand position of the major food and non-food crops during the current agricultural year, July 1975 to June 1976, is reviewed in the following paragraphs.

Rice

During 1975-76, the output of rice is expected to be at a record level of 46 million tonnes as against about 41.50 million tonnes in 1974-75. As a result, the supply position of rice is likely to be satisfactory during the current year. As can be seen from Table 5, the prices of rice in the selected markets of the country declined in the range of 4 per cent to 16 per cent. During the week ended November 22, 1975, the official wholesale price index for rice at 342 was 6 per cent lower than the level a year ago. Among other developments, the State Trading Corporation has decided to export 40,000 tonnes of Basmati rice during 1975-76 to Gulf countries and the UK.

Wheat

During 1975-76, the output of wheat is expected to be at a record level of 30 million tonnes, against about 28 million tonnes in 1974-75. As a result, the supply position of wheat is expected to improve further during the next 12 months. The procurement of wheat during the 1975-76 marketing season (April-March) aggregated about 10 million tonnes till the end of November 1975 as compared to only 1.9 million tonnes during the corresponding period of last year. Reflecting the large output of wheat in 1974-75, the daily prices have also increased in the market. The prices of wheat in the selected markets of the country showed a decline of about 35 per cent over the previous year (Table 5). During the week ended November 22, 1975, the official wholesale price index for wheat at 323 was 18 per cent lower than the level a year ago.

Jowar

During 1975-76, the output of jowar (kharif plus rabi) is expected to be at 9 million tonnes as against about 8 million tonnes during 1974-75. As a result, the prices of jowar in the Hapur and Shirampur markets at Rs 125 and Rs 160-168 per quintal on November 29, 1975 showed steep decline of 28 per cent and 14 per cent respectively over the past year.

Bajra

Following the favourable weather conditions in the major bajra producing States, the output of bajra is expected to be larger at 7.50 million tonnes in 1975-76, against 4 million tonnes during 1974-75. Reflecting this, the prices of bajra in the Bombay Hapur markets during November 1975 showed sharp declines of 28 per cent and 56 per cent respectively as compared to the level a year ago (Table 5).

Maize

During 1975-76, the output of maize is expected to be at 5 million tonnes is expected to show a decline of 10 per cent as against about 5.5 million tonnes during 1974-75. However, the supply position of maize is expected to be generally satisfactory. Nevertheless, owing to increased production in Punjab and Uttar Pradesh, the prices of maize in the Bhatinda and Hapur markets during November 1975 showed a sharp fall of 56 per cent and 52 per cent respectively over the past year.

Table 5 : Spot prices of agricultural commodities—November 1973 to 1975

Commodity	Market	Variety	As on November 30, 1973	As on November 30, 1974	As on November 29, 1975	Percentage variation in November 1975 over	
						1974	1973
Foodgrains							
(1) Rice	Calcutta	Common	425-440	330-335	280-285	-15.0	-34.7
	Delhi	Basmati	240-335	360-410	280-370	-15.6	+13.0
	Hapur	Basmati	265-275	350-400	300-330	-16.0	+16.7
	T'gudem	Akkulu (New)	145.94	200	192.85	- 3.6	+32.1
(2) Wheat	Bhatinda	Farm	100.25-110.70	130.80-135.70	120-127.40	- 7.2	+17.3
	Delhi	Deshi	115-125	225-270	140-155	-40.4	+22.9
	Hapur	White Farm	110-115	240-245	105	-56.8	- 1.8
	Sonepat	Farm	82-92	162-165	99-105	-37.6	+17.2
(3) Barley	Bhatinda	Common	110.30-115.70	130.70-140.50	55.70-60.30	-57.2	-48.7
	Hapur	Common	115	135-140	60-62	-55.6	-47.0
(4) Jowar	Hapur	White	95	170	125	-26.5	+31.6
	Shrirampur	White	145-165	188-195	160-168	-14.4	+ 5.8
(5) Bajra	Bombay	Superior	130	185-205	130-150	-28.1	+ 7.7
	Hapur	Common	120	175-190	80	-56.2	-33.3
(6) Maize	Bhatinda	Common	75.70-80.25	150.60-157.60	70.70-77.50	-51.9	- 5.0
	Hapur	Common	95-100	185-190	65-74	-62.9	-28.7
(7) Gram	Bombay	Deshi	218-225	250-260	180-190	-27.5	-16.5
	Hapur	Common	170-210	210-230	150-175	-26.1	-14.5
	Rohtak	Kabli	295-305	330-350	210-240	-33.8	-25.0
Fibres							
(1) Cotton	Bombay	R. G. 320F (A)	727	728	647	-11.1	-11.0
	Bombay	Hybrid-4	1,294	942	1,111	+17.9	-14.2
	Bombay	L-147 (A)	889	815	801	- 1.7	- 9.9
	Bombay	Laxmi (A)	1,178	872	844	- 3.2	-28.4
	Bombay	C. J. 73	734	724	664	- 8.3	- 9.5
	Bombay	Bengal Deshi	478	576	478	-17.0	
(2) Jute	Calcutta	Assam Bottoms	139.32	176.83	180.65	+ 2.2	+29.7
III. Groundnut and its oil							
(1) Groundnut (Kernels)	Bombay	Karad bold	330	372	248	-33.3	-24.9
	Hyderabad	Common	335-353.75	350-375	237.50-275	-29.3	-25.6
	Rajkot	Common	306	329.16	189.55	-42.4	-38.1
(2) Groundnut oil	Bombay	—	629.50	812.50	535	-34.2	-14.8
	Madras	—	660	760	565	-25.7	-14.4
	Rajkot	—	585	825	487.50	-40.9	-16.7
IV. Others							
(1) Sugar	Bombay	C-30	348	551-552	433-443	-20.6	+25.9
	Muzaffarnagar	Crystal	385-392	550-535	442	-18.5	-13.8
(2) Khandsari ..	Hapur	Superior	310-335	410-460	310-320	-27.6	- 2.3
	Muzaffarnagar	Deshi Wet	287.50-360	400-462.50	285-340	-27.5	- 3.4
(3) Gur	Hapur	Pansera superior	112.50-115	130-132.50	115-120	-10.5	+ 3.3
	Shrirampur	Yellow keshari	185-192	177-182	167-169	- 6.4	-10.9
(4) Tea	Calcutta	Average	650	642	1,061	+65.3	+63.2
(5) Coffee	Coimbatore	Robusta Flat	650-660	810-820	810-820	—	+24.4

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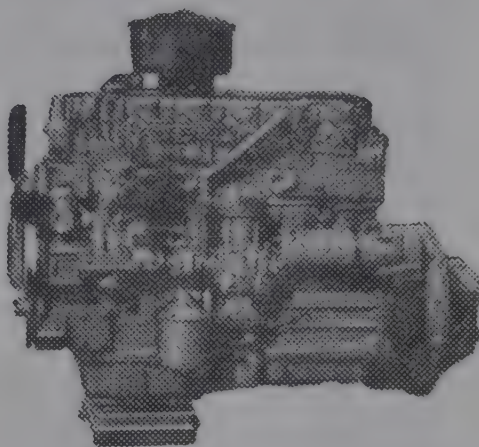
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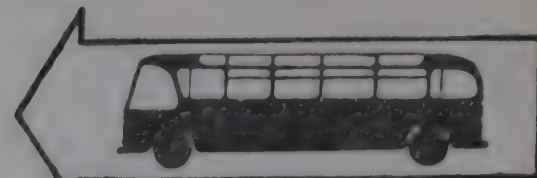
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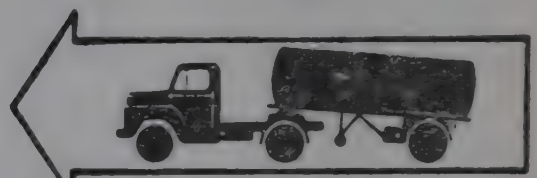
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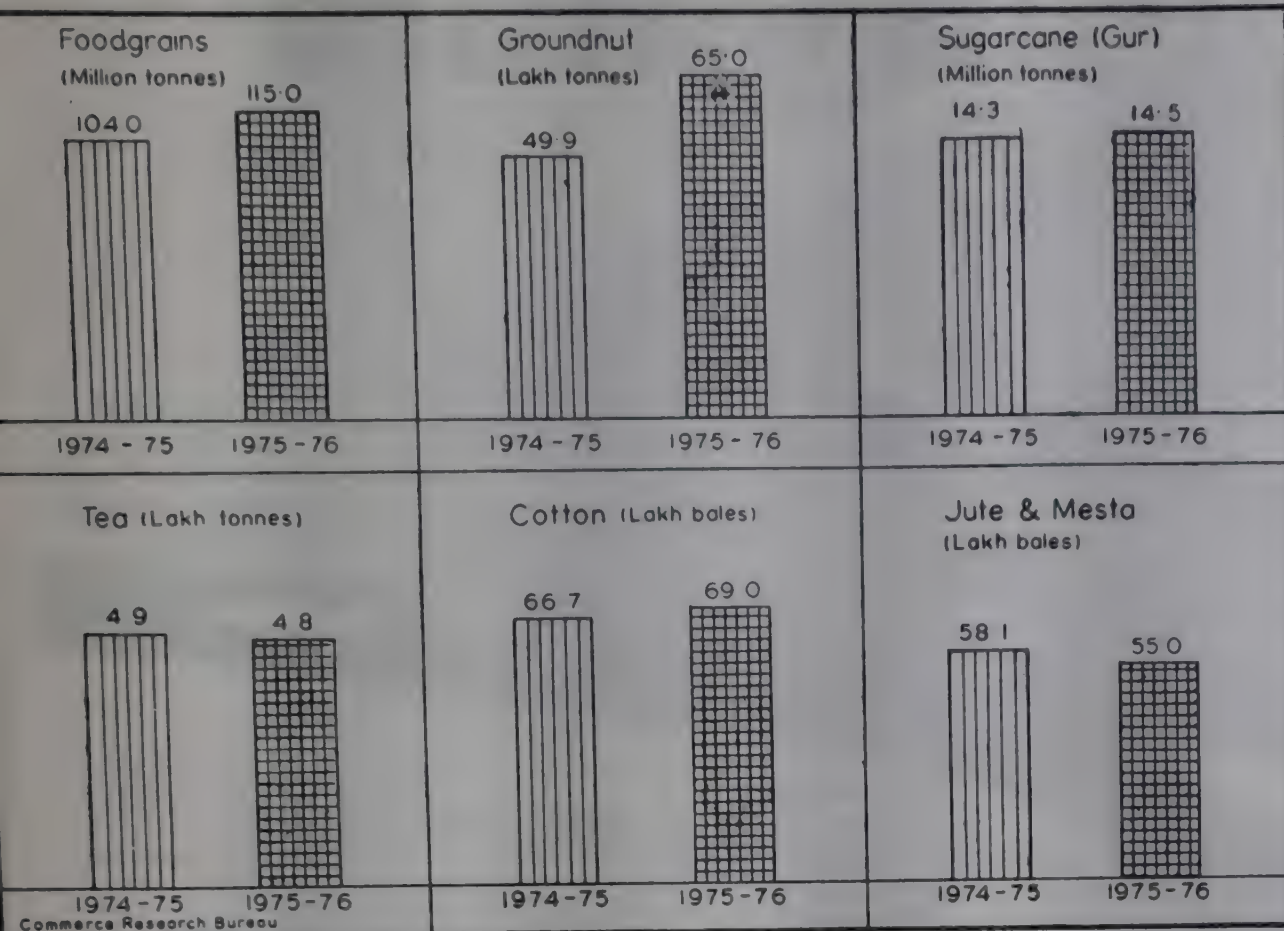


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Expected Output of Selected Crops : 1975-76



Gram

During 1975-76, the output of gram is expected to be at the last year's level of 5 million tonnes. The supply position of gram is likely to be generally satisfactory. The prices of gram in the Bombay and Rohtak markets at Rs 180-190 and Rs 210-240 per quintal on November 29, 1975 showed declines of 28 per cent and 34 per cent respectively over the previous year.

Cotton

For the 1975-76 season (September to August), the Cotton Advisory Board (CAB) has placed the production of cotton larger at 69 lakh bales as compared to the official estimate of 66.86 lakh bales of 180 kg each in the 1974-75 season. In addition, the government has decided to import one lakh bales of cotton during the current season. With carry over stock and import, the supply of cotton during 1975-76 is expected to be 94 lakh bales, against the demand of 76 lakh bales. Hence, the supply position of cotton continues to be very comfortable. The government has imposed a ceiling of 1.50 lakh bales on the export of Bengal Deshi cotton during the 1975-76 season. During the period September 1, 1975 to October 29, 1975, about 1.04 lakh bales of Bengal Deshi cotton were registered for export sales as compared to only 0.14 lakh bales during the corresponding period of last year. The prices of cotton in the Sewrimarket of Bombay

declined during the past year (Table 5). This was mainly due to the expected bumper harvest and the credit squeeze. During the week ended November 22, 1975, the official wholesale price index for cotton at 260 was 11 per cent lower than the level a year ago.

Meanwhile, the Maharashtra government has decided to continue its monopoly procurement scheme during the 1975-76 season also, although the actual fate of the scheme will depend on the availability of finance, which is as yet in doubt. Among other developments, the Agricultural Price Commission (APC) has recommended a higher support price of Rs 210 per quintal for the basic average quality of Punjab American kapas for the 1975-76 season, against Rs 195 per quintal recommended for the previous season.

Jute

During the 1975-76 season (July-June), the combined output of jute and mesta is estimated lower at 55 lakh bales as against the official estimate of 58.2 lakh bales in 1974-75. However, the supply position of this fibre would remain satisfactory due to the sizable carry over stock of about 21 to 25 lakh bales from the preceding season's crop. Meanwhile, the Union government has also decided to import about 2 lakh bales of jute from Bangladesh during the current season. Against the total

ANNUAL REVIEWS

supply of 81 lakh bales in 1975-76, the demand is placed at 75 lakh bales.

The government has fixed a minimum support price at Rs 135 per quintal for the Assam Bottoms variety of raw jute for the 1975-76 season as compared to Rs 125 per quintal fixed for the previous season. The prices of Assam Bottoms in the Calcutta market at Rs 180.65 per quintal on November 29, 1975 showed a marginal rise of 2 per cent over the preceding year. In the meantime, the Jute Corporation of India (JCI) has fixed the procurement target of 25 lakh bales of raw jute for the 1975-76 season. The JCI has purchased about 4 lakh bales of raw jute till November 22, 1975 during the current season.

Oilseeds

During 1975-76, the output of five major oilseeds—groundnut, rapeseed and mustard, sesamum, linseed and castorseed—is estimated larger at about 101 lakh tonnes as against the official estimate of 84 lakh tonnes during 1974-75. This is due to the bumper groundnut crop following the favourable weather conditions in the major groundnut-producing States of the country. Reflecting this, the supply position of edible oils is expected to be comfortable during the year.

Meanwhile, the new groundnut crop has started arriving heavily in the major producing States of Andhra Pradesh, Gujarat, Tamil Nadu, Karnataka and Maharashtra. As a result, the prices of groundnut and groundnut oil in the selected markets of the country showed a sharp decline of 25 to 30 per cent during the past one year (Table 5). During the week ended November 22, 1975, the official wholesale price index for groundnut at 274 was 31 per cent lower than the level a year ago.

Sugar

For the 1975-76 season (October to September), the output of sugarcane (gur) is placed about the same as last year's level of 14.3 million tonnes. However, the output of sugar is estimated lower at about 45 lakh tonnes during 1975-76, against the all-time record level of 47.94 lakh tonnes in 1974-75 and 39.50 lakh tonnes in 1973-74. Hence, the supply position of sugar is expected to be satisfactory. Reflecting this, the price of sugar in the Bombay market at Rs 433-443 per quintal on November 29,

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5 showed a sharp fall of 21 per cent during the past one year. Similarly, the prices of gur and khandsari also moved down in the selected markets of the country in sympathy with sugar (Table 5). During 1974-75, the domestic consumption of sugar was about 35 lakh tonnes i.e., about the same as that in the previous year. The export of sugar was placed at 13 lakh tonnes during 1975-76, valued at Rs 475 crores, against about 7 lakh tonnes valued at Rs 314 crores in 1974-75. Thus, sugar is emerging as one of the major earners of foreign exchange.

Among other developments, the Union government has raised the basic excise duty on free sale sugar from 30 per cent to 37½ per cent on *ad valorem* basis for the 1975-76. The excise duty on khandsari sugar has been changed from the compound duty imposed on ad basis to that on *ad valorem* basis. Now the duty has been levied at the rate of 17½ per cent *ad valorem*. For December 1975 the tariff value of free sale sugar was fixed at Rs 300 per quintal. The Union government announced, on November 25, 1975, incentives such as a higher percentage for free sale sugar and an excise duty concession in respect of new sugar units and the expansion of existing units of the sugar industry for 1975-76 to 1979-80.

Tea

During 1975, the production of tea is expected to be 482 million kg against the actual production of 485 million kg in 1974. The supply position continues to be satisfactory. During 1974-75 (April-March), India exported 217 million kg of tea valued at Rs 215 crores. For 1975-76, the export target for tea has been fixed at Rs 240 crores. However, the domestic demand for tea has been steadily increasing. As a result of this, the price of tea in the Calcutta market, at Rs 1,061 per quintal on November 29, 1975, was 65 per cent higher than the level a year ago.

Coffee

For 1975-76, the production of coffee is placed at the previous year's level of 92,000 tonnes. The supply position continues to be comfortable. Currently, the area under coffee cultivation is 1.39 lakh hectares. During 1974-75 the exports of coffee were 55,708 tonnes valued at Rs 58.44 crores. The export target for the current year is fixed at about 60,000 tonnes. The prices of coffee (Robusta flat) in the Coimbatore market at Rs 810-820 per quintal on

November 29, 1975 showed no net change over the previous year.

Rubber

During 1975-76, the production of natural rubber is estimated larger at 1.45 lakh tonnes as against 1.30 lakh tonnes in 1974-75 and 1.25 lakh tonnes in 1973-74. According to the latest data on production and consumption of natural rubber released by the Rubber Board in December 1975, the production of rubber during the period April to September 1975, increased by about 15 per cent as compared to the corresponding period of 1974, while the consumption during the same period dropped by about 4 per cent. The prices of rubber in the Kottayam market at Rs 790 per quintal during November

INDUSTRIAL PRODUCTION: 1975

Remarkable improvement

By COMMERCE RESEARCH BUREAU

THE industrial production in 1975 is likely to record a substantial improvement of 5 to 6 per cent after a poor increase of about 2 per cent in 1974 and the negligible increase of less than one per cent in 1973.

Table 1: Index of industrial production
(Base: 1970=100)

Year	Index	Percentage change over the previous year
Fourth Plan		
1969 (a) ..	95.1	—
1970 ..	100.0	+ 5.2
1971 ..	105.0	+ 5.0
1972 ..	113.4	+ 8.0
1973 ..	114.5	+ 0.9
Fifth Plan		
1974 (a) ..	116.5	+ 1.7
1975 (a) ..	122.9	+ 5.5
Annual compound rate of increase (per cent) between: 1973 and 1975		
	+ 3.4	—

(a) Commerce Research Bureau estimates

The likely annual compound rate of increase of over 3 per cent between 1973 and 1975 would be still less than half of 8 per cent envisaged during the Fifth Five Year Plan.

The significant improvement in industrial production in 1975 can be attributed to the following factors:

(a) Disappearance of shortage of coal which prevailed in earlier years due to transport bottlenecks and of

ANNUAL REVIEWS

1975 showed a rise of 5 per cent over the past year. However, the current price is lower by Rs 170 per quintal as compared to the peak level of Rs 960 in January 1975. Mr K. M. Chandy, Chairman of the Rubber Board, has suggested that export of some quantity of rubber, even if the government had to give subsidy, would be a permanent solution to the problem of falling prices of rubber in the country. The Indian Rubber Growers' Association has pleaded for raising substantially the minimum support price of Rs 520 per quintal fixed in 1969 as the cost of rubber has increased over the past six years.

basic industrial raw materials such as steel, non-ferrous metals, and intermediate chemicals;

(b) Total or near-total withdrawal or drastic power restrictions in industrially advanced States like Maharashtra, West Bengal, Gujarat, Tamil Nadu, Haryana and Punjab; and

(c) Dramatic improvement in the labour situation following the declaration of Emergency.

As a result, there has been a substantial improvement in the output of a number of capital goods industries, intermediate goods industries and consumer industries (Table 2). These industries together account for about 62 per cent of total weight in the official Index of Industrial Production (IIP). Consequently, there has been a significant improvement in capacity utilisation in the case of a number of industries during 1975.

However, cotton textiles, jute textiles, air conditioners, passenger cars, jeeps, dry cells and radio and transistor sets, fans, refrigerators, sewing machines, storage batteries, TV sets and some other industries have been suffering from inadequate or sagging demand. Except for cotton textiles and jute textiles, the manufacturers of the consumer durable goods industries are reported to have effected a cut in the production during 1975. These industries together account for about 4

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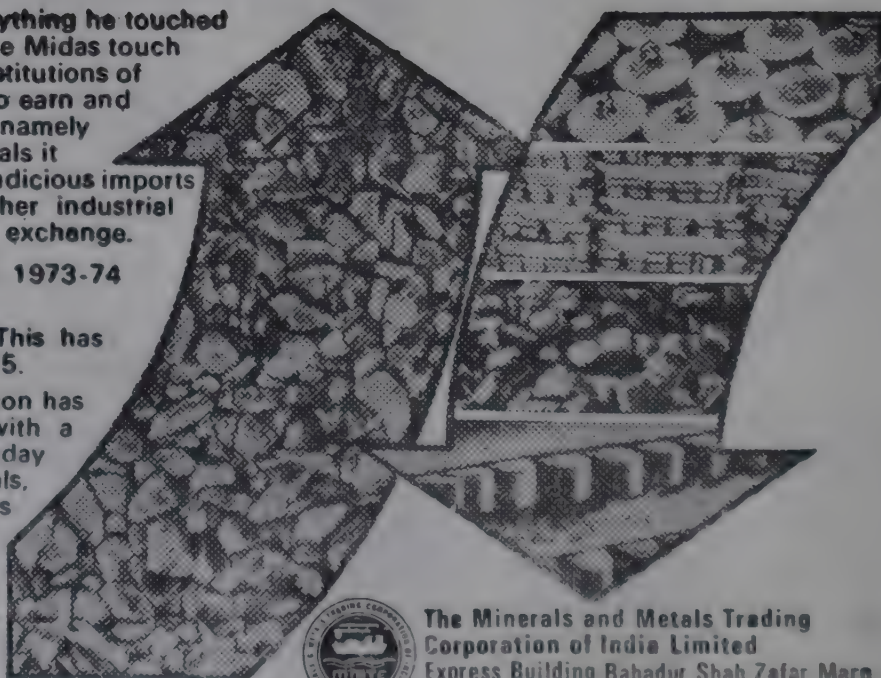
MMTC STRIKES IT RICH... BOTH WAYS

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Total mineral exports of the country during 1973-74 were of the order of Rs. 175 crores.

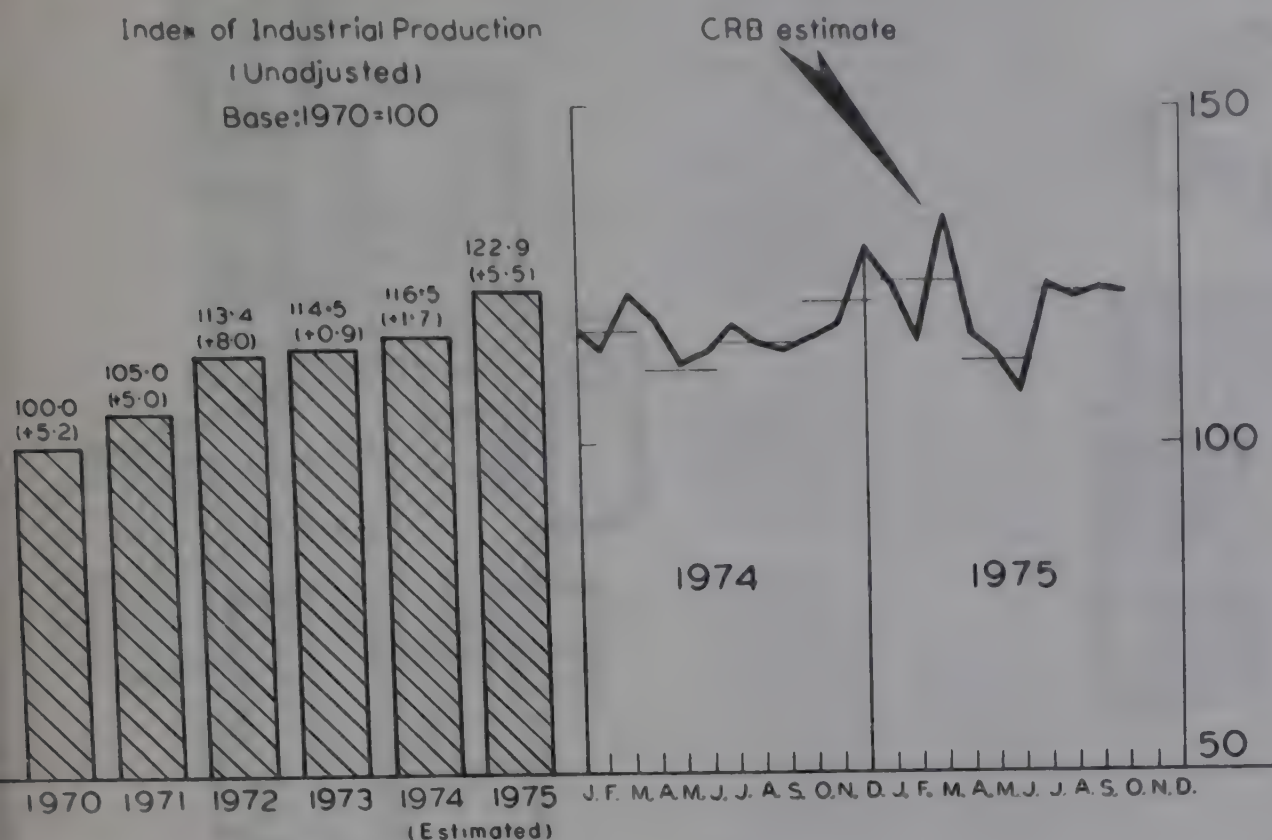
MMTC's contribution was Rs. 125 crores. This has now risen to about Rs. 140 crores in 1974-75.

The range of items imported by the Corporation has increased from year to year. Beginning with a single item, namely copper, the Corporation today imports more than 50 different raw materials, ranging from non-ferrous metals to fertilizers and raw materials for fertilizers. As a result of proper procurement planning MMTC is today in a position to supply all the raw materials it imports on an "off-the-shelf" basis.



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Significant Improvement in Industrial Production : 1975



NOTE: Each horizontal line indicates the average for respective quarter

er cent of the total weight in the
ndex of Industrial Production.

The term recession can be best defined as a fall in production in response to less-than-before demand. Going by this definition, one can speak of recession only in respect of cars and jeeps (but not commercial vehicles) and a few other consumer durables such as fans, radio sets and TV sets. There also appears to be recession in the case of mini-steel plants but certainly not in the major steel plants which account for the bulk of the steel production in the country. Besides, there is a major case of cotton and jute textiles where while the production has not shown any drop, despatches have fallen and stocks have been mounting. In a certain sense, one can concede that there is recession in these industries. Judged by the latest reports, it seems the recession may disappear within the next few months because of the good kharif harvest and equally bright prospects for the rabi crops.

But from these—and some other—instances, it would not be valid to draw the inference that by and large the Indian economy is passing through a phase of recession. On the contrary, production has been rising in every major segment of the industrial sector. Not only that, even the likely rate of increase of industrial production during the current year at about 6 per cent appears to be higher than in any

other year during the past five years except 1972.

It might perhaps be argued that while the production is rising, goods are not being sold. Maybe, the increase in sales does not keep pace with the increase in production in some sectors. But what is relevant in this context is the fact that despatches and consumption are higher than in the preceding one or two years in respect of almost every sector or broad groups of industries.

A remarkable feature of the industrial situation in the country during 1975 has been the growth in production in a number of public sector undertakings.

Apart from coal, steel and nitrogenous fertilisers, the production of heavy electrical plants, non-electrical machinery, dry core cables, non-ferrous metals and insecticides in public sector undertakings showed a marked increase. The overall growth of output of public sector undertakings during the first six months of 1975-76 was about 10 per cent higher than that in the corresponding period of 1974-75.

It was reported that about 17 industries had been nursing stocks for the third quarter of 1975 because of the sagging demand. But it appears that currently only four out of 17 industries have stocks representing beyond one month's average production. These industries are zinc, tyre cord,

ANNUAL REVIEWS

phosphatic fertilisers and leather footwear.

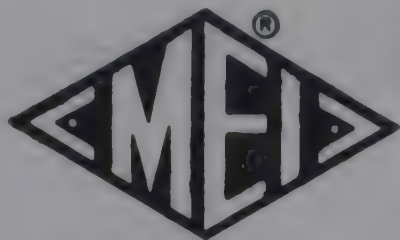
This apart, coal, manganese ore, aluminium, steel ferrous scrap, ferro-

Table 2: Trends in production of selected industries

Industry	Weight	Percentage change (a)
I. Capital goods industries	3.79	—
Commercial vehicles ..	2.39	+ 2.3
Machine tools ..	0.66	+10 to 15
Tractors ..	0.41	+12.8
Jeeps ..	0.29	—11.1
Three wheelers ..	0.04	— 4.8
Department of heavy industry (Public sector undertakings)	—	+37.0
II. Intermediate industries	43.51	—
Electricity ..	9.23	+10.3
Cotton yarn ..	7.70	+ 4.3
Coal ..	6.24	+12.0
Saleable steel ..	3.87	+15.8
Jute textiles ..	3.34	+ 4.4
Rubber products (b) ..	2.74	+ 4.3
Petroleum products ..	2.00	+ 5.2
Crude oil ..	1.67	+ 9.7
Cement ..	1.45	+15.5
Nitrogenous fertilisers	1.07	+28.8
Automobile tyres ..	1.07	Above +15
Pig iron ..	0.93	+15.2
Aluminium ..	0.68	+20.3
Nylon yarn ..	0.54	+36.0
Caustic soda ..	0.39	+ 1.3
Soda ash ..	0.27	+10.0
P.V.C. resins ..	0.15	Above +15
Calcium carbide ..	0.07	+10 to 15
Polystyrene ..	0.04	Above +15
Low density polyethylene ..	0.03	+10 to 15
Steel ingots ..	0.03	+14.5
Graphite electrodes ..	0.02	+10 to 15
Blister copper ..	0.01	+102.2
Naphtha ..	—	+14.2
Industrial gases ..	—	+10 to 15
Nylon tyre cord ..	—	+10 to 15
D.D.T. ..	—	Above +15
Scooter tyres ..	—	Above +15
III. Consumer industries	19.02	—
Cotton fabrics ..	6.59	+ 3.6
Sugar ..	3.44	+22.0
Tea ..	3.18	+ 0.4
Paper and paperboard ..	2.71	— 1.1
Cars ..	0.90	—38.6
Vanaspati ..	0.83	+25.2
Soap ..	0.75	+25.0
Matches ..	0.32	Above +15
Razor blades ..	0.16	+10 to 15
Motor cycles ..	0.13	+36.5
Scooters ..	0.13	+ 4.1
Detergents ..	0.01	Above +15
Leather footwear ..	—	Above +15
Mopeds ..	—	+30.3

NOTES:

- Percentage changes have been worked out on the basis of: (i) first 10 or 8 months of 1974 and 1975, (ii) first 7 or 6 months of 1974-75 and 1975-76.
- Based on consumption of raw rubber which is a good indicator of rubber products industries.



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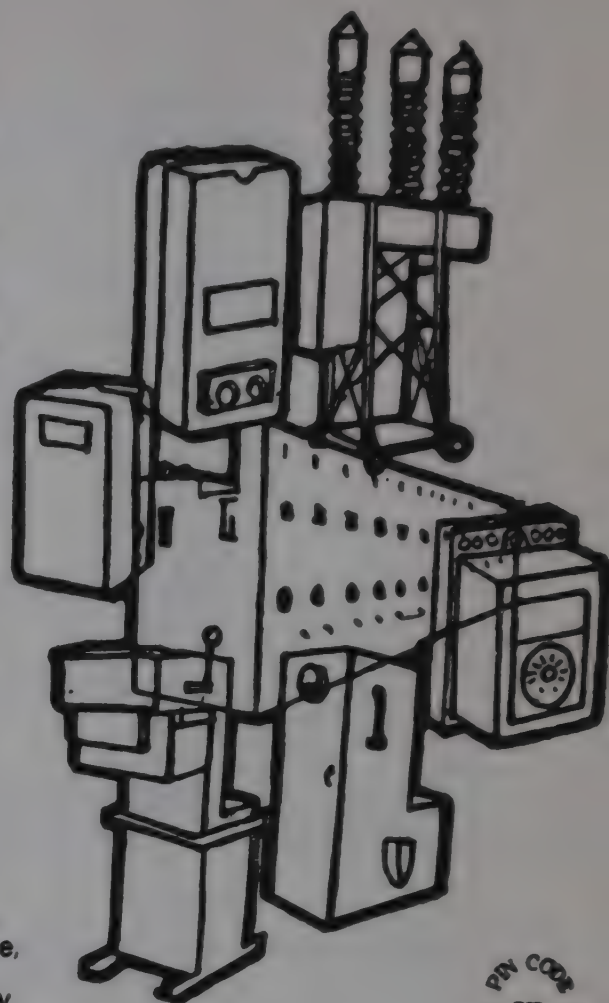
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3. I am sure you will find in them a friend indeed.

With kind regards,

Yours sincerely,

Prakash

on, newsprint, automobile tyres, printing paper, salt, cotton textiles, jute textiles, processed cashew, caustic soda, calcium carbide, jeeps and cement are some other industries complaining about accumulation of unusually large stocks.

Although some of these industries have indicated the level of stocks at a point of time, it is debatable whether the level of stocks is really in excess of the normal level of stocks which the manufacturers usually maintain. In the absence of comparable data on stocks (in terms of so many days' production), it is not possible to assess in quantitative terms the magnitude of the excess of stocks over normal levels.

Latest official data for production in different industries are available up to March 1975. For selected industries, comparative production data covering the first 10 months of 1974 and 1975 have been compiled by Commerce Research Bureau from various authoritative sources. These data are presented in Table 3. Based on these data, the performance of some of the industries is discussed in the following paragraphs.

Electricity generation

Electricity generation during the first 10 months of 1975 was about 10 per cent higher than that in the corresponding period of 1974. This sharp improvement was possible due to the

increased supply of coal to thermal power stations and a substantial increase in the levels of hydel reservoirs following good rains this year. Barring a few States, power restrictions have been almost lifted. Hence, one may expect that more or less the same high tempo of power generation is likely to be maintained till mid-1976.

Cotton textiles

Despite the mounting stocks of cotton yarn and fabrics, the cotton textile mills produced more during the first 10 months of 1975 than in the corresponding period of 1974. Easy availability of cotton, coal and power was primarily responsible for the increase in the textile output in 1975.

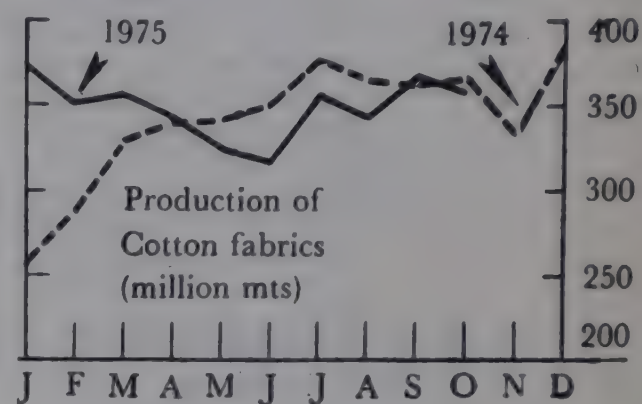
Nevertheless, textile industry has been passing through a severe crisis of demand recession in domestic as well as overseas market. Consequently, at the close of September 1975, the unsold stocks of cotton fabrics with the mills attained an all-time record of 1.98 lakh bales of 1,500 metres each or the equivalent to 25 days' production by textile mills. But there was a welcome decline in the level of unsold stocks in the following two months, partly because of a decline in production and partly due to the improved offtake.

The stocks of fabrics have accumulated mainly because of (i) stiff con-

ANNUAL REVIEWS

sumers' resistance to the prevailing cloth prices; (ii) poor quality of controlled cloth produced by many mills just to fulfil the obligation imposed by the Government; and (iii) the failure of the National Co-operative Consumers' Federation to lift the stipulated stocks from the mills.

To enable the composite mills to dispose of the unsold stocks quickly, a number of measures, such as approval of other trading channels including the participation of the private trade in the



sale of the controlled cloth, were announced by the Textile Commissioner. But these steps did not help much immediately to revive demand and a number of textile mills started falling sick.

Hence, on December 2, 1975, the Government announced a four-point programme to tackle the problem of the ailing textile industry.

(1) All financially weak mills have been exempted from the obligation to produce controlled varieties of cloth with immediate effect. The exemption has been granted for one year but if the offtake of cloth improves in the meanwhile, the Government will ask them to restart production of cheap cloth.

(2) Mills with a good export performance may also get relief from cheap cloth manufacture.

(3) The criteria for identifying financially weak mills have been evolved. All mills with carry over losses in 1974 balance sheets or subsequent ones will qualify for exemption. But the final decision will rest with the Textile Commissioner.

(4) A selective programme of modernisation on a crash basis will be implemented. Sick mills and mills under the National Textile Corporation will have a preferential claim on the

Table 3 : Production of selected industries in recent months

Industry	Weight in the official Index	Unit	January-October		Percentage change in 1975 over 1974
			1974	1975	
Showing rise in production :					
Electricity	9.23	Mln Kwh	56,126	61,910	+ 10.3
Cotton yarn	7.70	Mln Kg	782	816	+ 4.3
Cotton fabrics	6.59	Mln mt	3,366	3,486	+ 3.6
Saleable steel	3.87	'000 tn	3,838	4,443	+ 15.8
Sugar	3.44	'000 tn	3,030	3,698	+ 22.0
Jute textiles	3.34	'000 tn	757.3	790.8	+ 4.4
Tea	3.18	Mln Kg	418.7	420.2	+ 0.4
Rubber products	2.74	'000 tn	142.2	148.3	+ 4.3
Cement	1.45	'000 tn	11,450	13,230	+ 15.5
Pig iron	0.93	'000 tn	5,228	6,025	+ 15.2
Vanaspati	0.83	'000 tn	2,705	3,387	+ 25.2
Aluminium	0.68	'000 tn	108.6	130.6	+ 20.3
Tractor	0.41	'000 No	22.6	25.5	+ 12.8
Caustic soda	0.39	'000 tn	324.6	328.8	+ 1.3
Soda ash	0.27	'000 tn	415.0	456.5	+ 10.0
Motor cycle	0.13	'000 No	41.9	57.2	+ 36.5
Scooter	0.13	'000 No	70.4	73.3	+ 4.1
Steel ingots	0.03	'000 tn	4,755	5,444	+ 14.5
Copper	0.01	'000 tn	9.1	18.4	+ 102.2
Showing decline in production :					
All automobiles	3.60	'000 No	75.4	63.0	— 16.4
Car	0.92	'000 No	31.6	19.4	— 38.6
Jeep	0.29	'000 No	9.0	8.0	— 11.1
Heavy vehicle	2.39	'000 No	34.8	35.6	+ 2.3
Three wheeler	0.04	'000 No	10.4	9.9	— 4.8
21 Industries	48.99				+ 6.9
All Industries	100.00				+ 4.8

They saved the ancient banyan tree and now their daring knows no bounds

'Let it stand,' someone said of the banyan tree as the site was being cleared for the Hindustan Lever Research Centre, at Andheri.

So the tree still stands — and it stands for quite a lot. For one thing, the tree signifies that we can't easily get away from what is home-grown. Appropriately, therefore, the Centre will tackle problems rooted in India — the kind that can only be solved here:

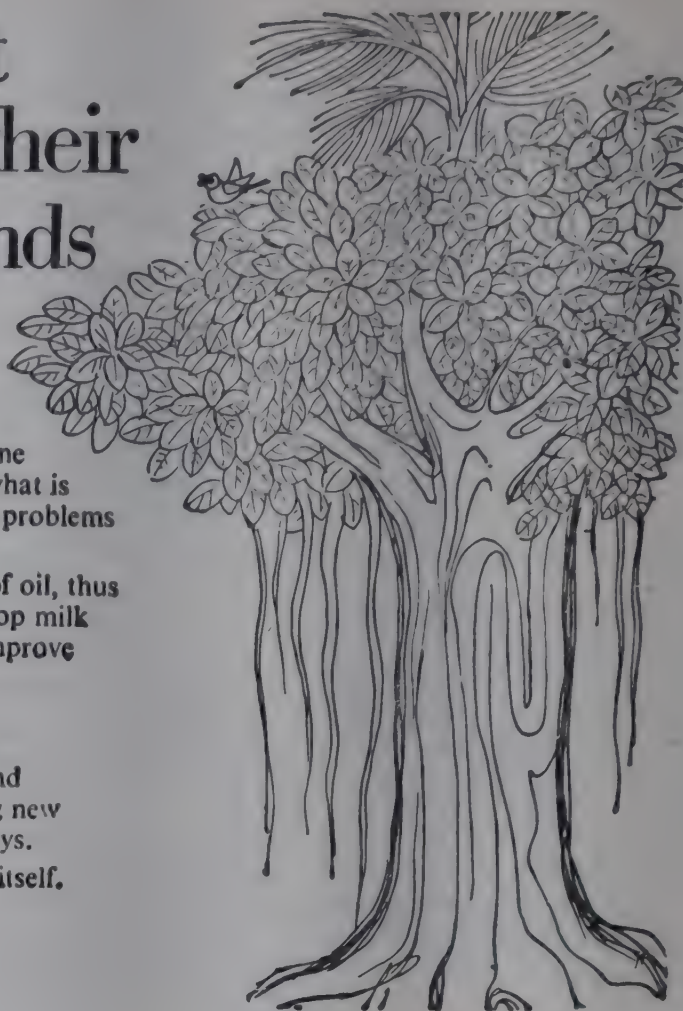
Can we discover and exploit hitherto unused *local* sources of oil, thus cutting imports and saving foreign exchange? Can we develop milk foods that are ideally suited to *Indian* needs? How can we improve the nutritive value of protein-poor foods? Can we develop processes for the preservation of Indian type food dishes?

Research on all this can only begin at home. It has, at the Hindustan Lever Research Centre in Andheri. The sweep and thrust of the studies are daring. The scientists are producing new devices for old, making traditional things happen in new ways.

They have, of course, left the banyan tree alone to grow by itself.

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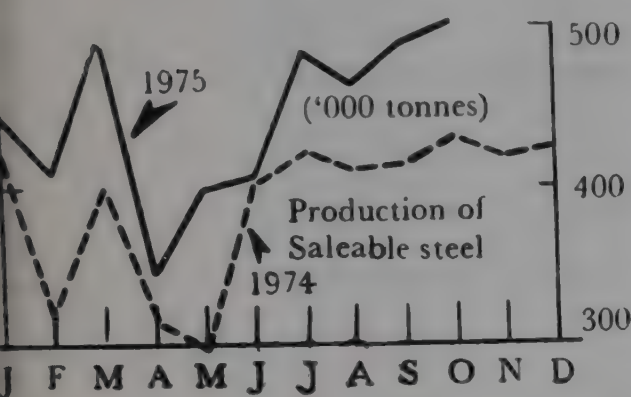
ls for modernisation to be made available by the nationalised banks.

Although the above measures should be considered from a long-term point of view, one may expect a revival in demand for fabrics during the next few months, particularly after December 1975 when the kharif and rabi crops are harvested.

Iron and steel

The output of saleable steel by the major integrated steel plants in the country was 16 per cent higher in the first 10 months of 1975 than that in the corresponding period of 1974. If the same trend continues, the output of saleable steel would be around 5.9 million tonnes in 1975-76 against 4.9 million tonnes in 1974-75. This marked improvement is mainly due to the adequate availability of coking coal and power.

Except for steel plates and forgings, the demand for other categories



of steel was subdued partly because of less vigorous activity in the engineering industries sector and partly due to the restrictions imposed on construction of multi-storied buildings in August 1974 in view of the acute shortage of cement.

Because of rising production and lower offtake by the steel-consuming industries, the major steel plants reported accumulation of steel over the past few months in 1975. Billets, bars and rods (which are mainly used in construction) accounted for the major share in the accumulated stocks. One important factor which has accentuated the accumulation with producers is the heavy unloading of steel stocks by traders and the policy of minimal purchases adopted by consumers. In other words, accumulation with producers is only a counterpart of non-accumulation by traders and consumers.

Better performance of major steel plants had a telling effect on prices in the open market and a disastrous effect on the working of mini-steel plants and re-rolling mills. The premium

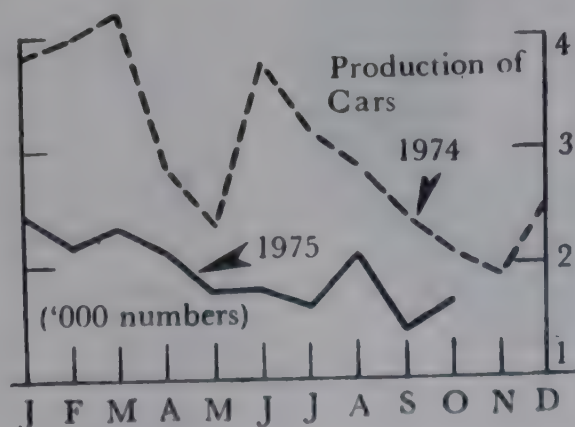
which steel products used to command in 1974 almost disappeared in 1975. In fact, despite the hike of Rs 80 per tonne in the average price of steel, items such as bars, rods and structurals were offered at discount or clubbed sales were resorted to by the steel producers. Similarly, though scrap and power were available during 1975, a number of mini-steel plants either closed down or they were forced to operate much below their installed capacity as their final steel products could not stand in competition with the ruling open market prices.

At the close of October 1975, the public sector steel plants and stock yards of Hindustan Steel Ltd together carried stocks of about 7 lakh tonnes, although despatches of saleable steel during the first 10 months of 1975 by the major integrated steel plants in the country were higher than those in the corresponding period of 1974.

It is expected that firm export orders to the tune of 12 lakh tonnes worth Rs 180 crores booked by the SAIL International and the recent relaxation in the case of construction industry together may help to reduce the accumulation of steel with the steel plants during the coming months.

Automobiles

The output of commercial vehicles, motor cycles, scooters, and mopeds recorded an improvement during the first 10 months of 1975 over that in the corresponding period of 1974. On the other hand, production of passenger cars, jeeps and three wheelers recorded a decline in response to the contracting demand for these vehicles. A sharp rise in prices of cars as well as petrol has been primarily responsible for decline in demand for these modes of transport. Similarly, a large



cut in the Government expenditure resulted in a sharp drop in demand for jeeps.

The recession in the automobile industry has in turn adversely affected output in auto ancillary industries.

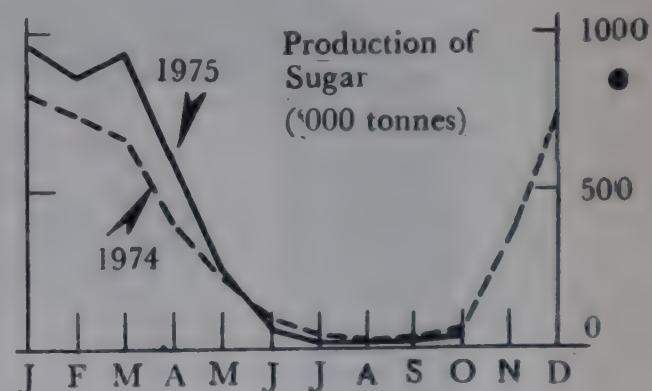
ANNUAL REVIEWS

The auto tyre industry reported accumulation of tyres with the manufacturers and the dealers.

In order to revive demand for automobiles the Union Government announced the following measures: (a) freezing of prices of principal ancillary components, (b) introduction of dual pricing system for passenger cars, (c) concessional rate of excise duty for cars used as taxis, (d) withdrawal of restrictions on purchase of more than one new car in any calendar year, (e) relaxation in sales tax by the State Government, and (f) the manufacturers and dealers on their part reduced the car prices by offering discounts. Despite these measures, there are yet no signs of revival in demand in the immediate future.

Sugar

The sugar output during the sugar season 1974-75 (October-September) established a new all-time record at 47.97 lakh tonnes against 39.48 lakh tonnes in 1973-74 and the previous high at 42.62 lakh tonnes in 1969-70. Easy availability of sugarcane and incentives in the form of rebate on excise duty offered by the Government were primarily responsible for the record production.



Although the sugar output was substantially higher in 1974-75, the total despatches for internal consumption were lower at 34.60 lakh tonnes than 35.22 lakh tonnes in 1973-74. The exports of sugar at 9.41 lakh tonnes in 1974-75 were significantly higher than 4.31 lakh tonnes in 1974-75. At the close of September 30, 1975, the total stocks of sugar with the mills were 12.21 lakh tonnes against 8.28 lakh tonnes at the end of September 30, 1974.

According to the Indian Sugar Mill Association, sugar production in the 1975-76 season is likely to be slightly lower at 44 lakh or 45 lakh tonnes.



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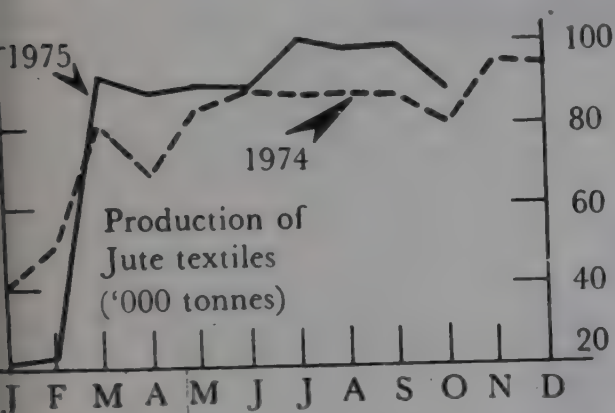
You can deposit as little as Rs 100—after 15 years you'll have more than four times of the original amount.

In order to achieve capacity expansion at a faster pace, the Union Government has announced some incentives in the form of additional free quota and excise rebate to the new jute mills and extended them to the existing mills contemplating expansion.

Jute textiles

Despite a 48-day strike by about 1.5 lakh workers engaged in 62 jute textile mills in Calcutta, the output of jute textiles was about 4 per cent higher during the first 10 months of 1975 than that in the comparable period of 1974. This improvement was mainly due to the easy availability of raw materials and power.

The jute textile industry suffered from inadequate demand for its products in the domestic as well as overseas markets particularly after March 1975. The setback in the offtake of jute goods in the domestic market was primarily due to the sharp fall in the offtake caused by the almost total absence of buying by the Government. This is a result of higher production of jute goods and lower offtake during the re-



cent months the level of stocks of jute goods with the mills was about 1.27 lakh tonnes at the close of October 1975 against 1.01 lakh tonnes at the end of October 1974. It is expected that because of the record kharif harvest in 1975-76 demand for sackings may pick up during the first half of 1976.

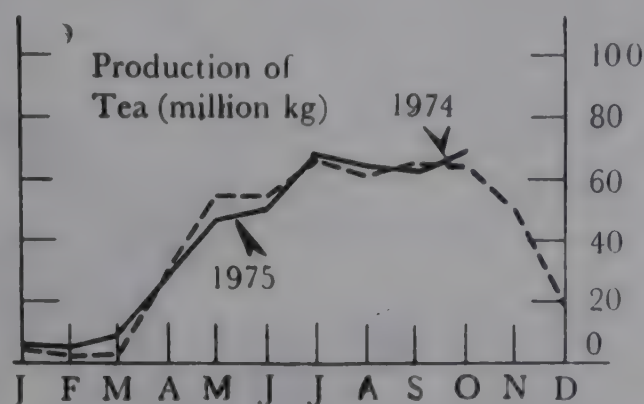
In order to help the jute textile industry which has been encountering stiff competition from synthetic bags in overseas markets, the Union Government decided to withdraw export duty on hessian with effect from June 1975 and, of late, the Union Government announced a cash compensatory support of 10 per cent of f.o.b. value for exports of jute carpet backing and jute specialities. It is hoped that these steps may help to reverse the falling trend of exports in the overseas market.

Tea

Tea output during the first 10 months of 1975 was marginally higher than that in the corresponding period

of 1974. If the same trend continues, the total output of tea in 1975 would be more or less at the same level of 1974.

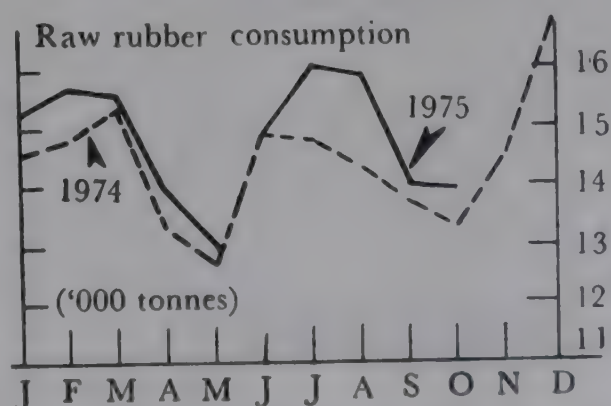
North Indian tea output recorded a decline during the first nine months of 1975 due to the unfavourable weather conditions. But this fall in the output was compensated by the substantial rise of 6.8 million kg in the South Indian tea output to 88.3 million kg.



Tea prices which were ruling firm till October have since declined. The total exports of tea during the first five months of 1975 were 78 million kg valued at Rs 82 crores against 71 million kg valued at Rs 74 crores during the same period of previous year. It is expected that the tea exports may realise record earnings of Rs 230 crores in 1975-76.

Rubber products

The consumption of raw rubber (which is a good indicator of the production of rubber products industries) was about 4 per cent higher during the first nine months of 1975 than in the corresponding period of 1974. Easy availability of raw rubber and power was mainly responsible for this improvement.



However, the auto tyre manufacturers who account for more than 60 per cent of the total raw rubber consumption reported accumulation of auto tyres during the second part of 1975.

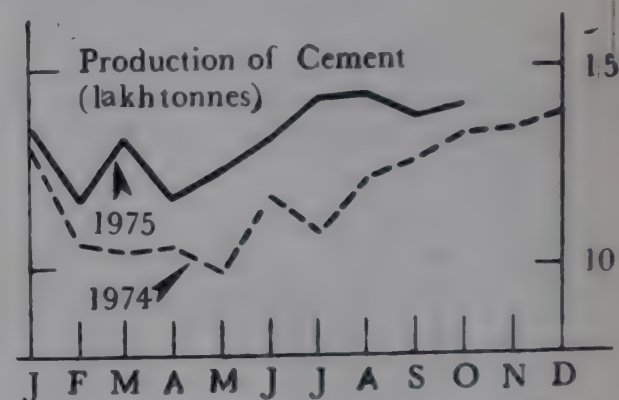
Cement

Because of improved availability of coal and power, the cement production during the first 10 months of 1975 was about 16 per cent higher than that in

ANNUAL REVIEWS

the corresponding period of 1974. At the beginning of 1975 when the capacity utilisation was about 75 per cent, the Government used to pre-empt for its own use 70 per cent of the production. But when the capacity utilisation improved to 90 to 95 per cent during the subsequent months the Government procured hardly 25 per cent of the total output because of paucity of funds.

Apart from the restriction on construction of multi-storeyed buildings since August 1974, the punitive action against smugglers, black marketeers, builders, etc had reduced to a great extent hoarding tendencies. All these factors taken together—but mainly the sharp improvement in production—helped to ease supply position and a sort of buyer market developed during the second part of 1975. The premium over the control price of cement has practically disappeared and the price in the open market has stabilised around or above the control price of Rs 19 per bag of 50 kg.



Since in all probability the Government's construction programme is bound to get momentum and there are all possibilities of sizable exports to the Arabian Gulf countries, the easy supply position of cement witnessed during the latter part of 1975 may not continue for long. In fact, despatches during the first 10 months of 1975 were 15 per cent higher than those in the corresponding period of 1974.

Vanaspati

Following the lifting of price control on vanaspati on January 4, 1975, the manufacturers attempted to increase the production of vanaspati during the subsequent months. The vanaspati production recorded a substantial improvement during the first 10 months of 1975 mainly due to the easy availability of edible oils, particularly groundnut oil and imported palm and sesame and sunflower oils, at reasonable prices.

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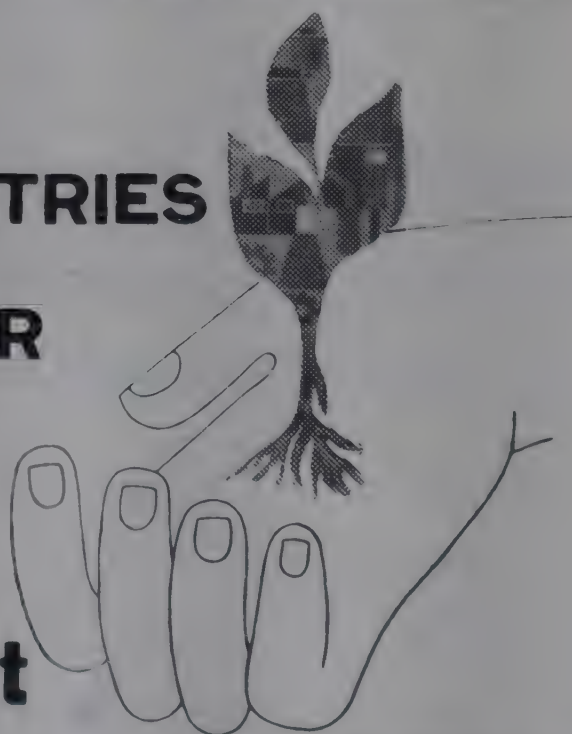
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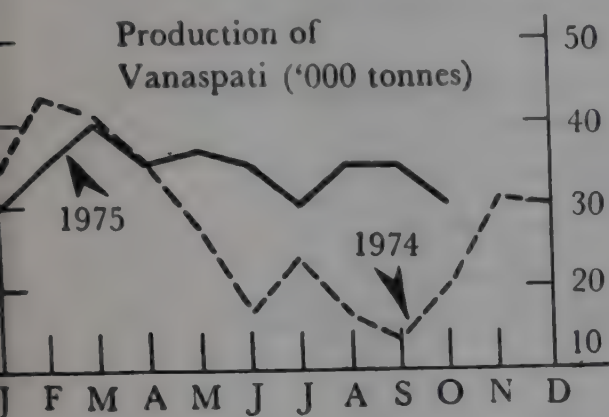
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Navnit-GIIC/25/75

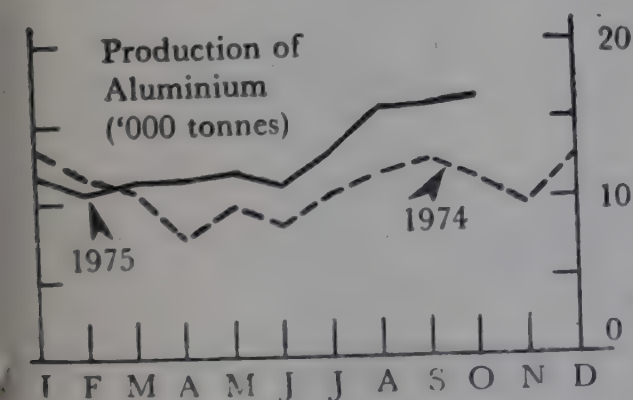
But, despite higher production and consequent improved supply position of vanaspati, the offtake of vanaspati did not pick up to the expectation. The commodity encountered a strong consumer resistance at the prevailing prices. Consequently, the manufacturers were compelled to reduce the price of vanaspati from Rs 159 to Rs 147 per tonne of 16.5 kg. It may appear strange that at one time the price of vanaspati was lower than that of the refined oil of certain popular brands.



Since the edible oil prices are likely to rule easy it is expected that prices of vanaspati also would be correspondingly reduced. To that extent, the offtake of vanaspati may gain momentum. The industry is likely to raise the vanaspati output to 6 lakh tonnes in 1976, against 4.5 lakh tonnes in 1975 and 3.6 lakh tonnes in 1974.

Aluminium

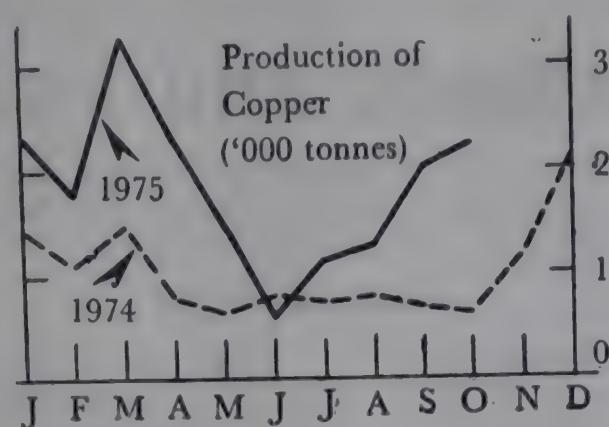
Despite mounting stocks of aluminium with the manufacturers, the output of aluminium during the first 10 months of 1975 recorded an increase of 20 per cent over the corresponding period 1974. This was primarily because of the easy availability of power in those States where aluminium smelters are located. Going by the current trend in produc-



tion, it is expected that aluminium production may go up to 1.9 lakh tonnes in 1975 against 1.20 lakh tonnes in 1974. In view of the improved availability of aluminium, the Government decided not to import EC grade aluminium with effect from November 21, 1975. On the contrary, because of the accumulation of stocks, the manufacturers may be allowed to export aluminium.

Copper

The output of copper showed an outstanding performance during the



INDUSTRIAL RELATIONS

Improvement in climate

By A SPECIAL CORRESPONDENT

THE proclamation of the emergency by the President of India on June 26, 1975 and the various measures announced to ensure that production was not interrupted, created more or less an electric effect on employer-employee relations in the country. As Mr K. V. Raghunatha Reddy, Union Labour Minister, put it, "an era of discipline, and a new economic era had begun in which the emphasis was on co-operation for economic growth." But he emphasised that there should not be any victimisation in the name of discipline nor any attempt should be made to take advantage of the sense of patriotism of the workers to deny them their legitimate claims.

Industrial relations had touched a new low last year resulting in the record loss of over 40.26 million man-days—almost double the 1973 figure. The all-India strike in railways in May, 1974 alone accounted for 94.9 per cent of the time-loss in all-India strikes and lock-outs. Out of 2,938 work stoppages reported during 1974, 428 were lock-outs. This resulted in the loss of 6.62 million man-days, apart from the loss caused by 164 political and sympathetic strikes.

The steps initiated to ensure industrial peace, following the promulgation of the emergency in June, have paid dividends in considerably bringing down the number of man-days lost. The loss in the third quarter of the year was 25 per cent of what it was for the corresponding period in 1974. Even during the three-month period for which the latest figures are available, strikes, lock-outs and closures have been fewer in successive months. The number of man-days lost in July was 830,000, in

ANNUAL REVIEWS

first ten months of 1974. This was mainly because of easy availability of power and commissioning of the Khetri smelter in Rajasthan. Both MMTC and Hindustan Copper Ltd reported accumulation of stocks of copper for want of adequate demand from the electrical engineering industries. But this should not pose any problem, for copper imports can be correspondingly brought down.

August 600,000 and in September, barely 130,000. For the corresponding period last year, the total was six million. The improvement in the industrial climate since July is also underlined by the fact that in the first two quarters of this year over 15.7 million man-days had been lost.

The coming together of employers and labour representatives in the bipartite industry-wise meetings, both at the Central and State level, has signified a distinct turn for the better in industrial relations. At these meetings schemes have been evolved to ensure higher production and productivity, quality control and full capacity utilisation. The process was also helped by the constitution of a national apex body for the private sector and separate national committees for various industries. The national apex body prescribes the guidelines for maintaining industrial peace. There are such bipartite committees set up by the State Governments also.

Role of trade unions

The year was also notable for some plain-speaking done by the Prime Minister in regard to labour-management relations and the frequent demands put up by the trade unions on the issues of wage rise, bonus, dearness allowance, etc. Speaking on March 27 on the true role of trade unions in developing countries before the Miners' International Congress held in New Delhi, Mrs Gandhi told the international trade unionists: "There is a tendency among workers in different sectors in a country to compare themselves with their counterparts in other countries.

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to a point this may be justifiable. A distinction has to be drawn between comparisons regarding humane and safe working conditions and those relating to wage levels and emoluments. The latter can be related only to wage levels prevailing in the other sectors of the country's economy. The trade union movement in developing countries cannot be insulated from the economic and social milieu in which it has to function...."

Again, addressing the chief executives, general managers and leaders of recognised labour unions in public sector undertakings, the Prime Minister said on July 12 that it was only through hard work, perseverance and discipline that the crisis through which the country was passing, could be faced. In life there is no miracle for anything, there is no magical remedy; the magic is each one of you. The magic is of hard work with sincerity, discipline and dedication", she asserted.

The Prime Minister reiterated this advice when she met the leaders of INTUC, AITUC and HMS on July 15 and told them that the trade union movement in India had patterned itself after the role of trade unions in the capitalist countries, that is, to organise themselves to get more benefits for the members of their own particular craft. "This was wholly inadequate in our context. Even in developed countries like the United Kingdom the traditional attitude had led to many economic crises. The trade unions in our country could certainly not afford to live in isolation from the social and economic context", affirmed the Prime Minister.

As late as on November 15, inaugurating the 56th session of the INTUC, the Prime Minister referred to the observation made by the organisation's Secretary that the Government Ordinance reducing the minimum bonus from 8.33 to 4 per cent and denying bonus altogether to certain categories had either curtailed or cancelled the existing rights of labour, and stated that labour leaders from communist and socialist countries had said to her: "How could you do this (get losing concerns to pay bonus)? How can you expect your industry to grow? How can you expect the society to change?" Mrs Gandhi, however, said that she would not say that the Indian working class did not deserve higher wages. But she asked: "Can they be a class by themselves ignoring the needs of other sections of the people?" According to Mrs Gandhi, this was a question

which the working class would itself have to consider and the Government for its part would be available for any discussion with it.

Bonded labour abolished

By an ordinance promulgated on October 24, 1975, the Government of India abolished the bonded labour system prevailing in the country. Its practice is now treated as a criminal offence and under the ordinance, every bonded labourer "stands freed and discharged from any obligation to render any bonded labour". Any violation of the ordinance means three years' imprisonment, or a fine of Rs 2,000 or both.

The important provisions of the ordinance are: Every bonded labourer in jail will be released immediately; no person freed under the ordinance from doing bonded labour will be evicted from his home. If he is evicted by the creditor, the executive magistrate in charge of the sub-division concerned will restore it to him; every attachment made for the recovery of bonded debt stands vacated; any property belonging to a bonded labourer or a member of his family, forcibly taken over by any creditor for the recovery of any bonded debt will be restored to him; and no civil court will have any jurisdiction with regard to any matter to which the ordinance applies. The ordinance also provides for the establishment of vigilance committees at the district and sub-divisional authorities on all matters connected with the enforcement of the ordinance.

Worker participation in industry

The Government of India announced on October 30 a scheme for workers' participation at the shop floor and plant levels to be adopted voluntarily by industries in the public, private and co-operative sectors, and units run departmentally. The scheme, which is in the shape of guidelines, is to be implemented in the first instance in manufacturing and mining industries.

It applies for the present to those units in these industries which have 500 or more workers on their rolls. It provides for shop councils at the shop department at all levels and joint councils at the enterprise level. The scheme, announced as part of the Prime Minister's 20-point economic programme, will be, to begin with, flexible so as to allow variations to suit local conditions and will be implemented through executive action. It has been left to the initiative of the managements to evolve a suitable pattern of participation depending upon

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the nature of each unit. Legislation will be considered after adequate experience is gained.

The scheme presents a two-tier participation model, namely, shop councils at the shop levels and joint councils at the enterprise level. The employer has to constitute a shop council consisting of not more than 12 representatives of management and workers for more than one department or shop, while the joint council will be formed for the unit as a whole. The representatives of workmen on both the shop council and the joint council will be from amongst the workers actually engaged in the unit.

Decisions taken at the meetings of these councils will be on the basis of consensus and not by a process of voting and have to be implemented within a period of one month. The functions of the shop council include suggestions for increasing production, productivity and overall efficiency of the shop including elimination of wastages. The joint council is to deal with optimum production, efficiency and fixation of productivity norms of man and machine for the unit as a whole.

The Labour Minister, Mr Raghubatha Reddy, has said that though the scheme did not provide for workers' participation at the management levels, the association of the workers in the production process would ultimately lead to the participation at the management level. He hoped that the public sector units would implement the scheme within a period of three to six months.

The Minister has also said that the Central Government would be the authority for the implementation of the scheme in the public sector undertakings. In the case of private sector units, the authority would be the appropriate State Government. Although the scheme was voluntary, he was hopeful that it would be adopted by units without any delay. He warned that any trade union which would not participate in implementing the scheme would have to regret it later on.

As regards the role of trade unions, Mr Reddy has explained that the Government did not want to combine the functions of trade unions with those of the joint councils. The sharing of profits in the undertakings was a negotiable issue and this would be

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It with by the recognised trade unions as at present.

The suggestion to associate workers more actively in the management enterprises in regard to day-to-day matters affecting them is not a novel idea. Industrial democracy in the form of joint management councils is being practised in units where they have been functioning for the last 18 years. However, their progress has been halting and leaves much to be desired. Initially, only 24 joint management councils could be set up. In the following years, there has hardly been any progress. On the contrary, there has been a distinct deterioration. According to the Ministry of Labour's latest Annual Report (1974-75), joint management councils functioned in 10 establishments—31 in the public sector and 49 in the private sector, whereas in 1956 there were 136 of which 42 were in the public sector and 94 in private sector. The reasons ascribed by the Ministry for unsatisfactory working of these bodies may be summed up in its own words: "The scheme of joint management councils has, however, not made much headway, due perhaps to the failure to develop a new positive attitude and institutions necessary for their working."

The role to be played by representatives of both the management and employees in making the new scheme a success deserves serious consideration. The past experience shows that the trade union leadership pays only lip service to the idea of consultation and co-operation. The managements are not reconciled to consulting labour. If the new scheme is to succeed, both the trade union leaders and managements will have to reorient their attitude towards each other and approach the scheme on a give and take basis.

It is understood from press reports that the central organisations of workers, though not fully opposed to the new scheme, have reserved their comments on some of the functions that are assigned to the shop and joint councils. For example, although, these councils envisage discussion for increasing production and productivity, no mention has been made of the manner in which the workers would be in a position to share the gains accruing to the management therefrom. It is, therefore, quite likely that such and similar issues will be raised by the labour representatives with Government when the National Apex Body meets on January 10-12, 1976.

According to the statistics of the Labour Bureau, there are about 1,411 factories, employing 2.2 million workers, who would be covered by the scheme in the manufacturing sector. These units account for 55 per cent of the employment and cover 2.5 per cent of the factories.

National Apex Body

Following the meetings convened by the Union Labour Minister in last July of the representatives of employers' and workers' organisations, Government announced that a National Bipartite Apex Body consisting of employers and workers had been set up to sort out the general problems in the private sector. The apex body meets periodically to discuss and review the general problems with a view to maintaining industrial peace and harmony in various industries. While the NAB is bipartite in character, the Union Labour Minister is also associated with its deliberations and whenever a problem concerning any other Ministry comes up, the Minister concerned is also invited.

The Committee has until the end of the year met five times. Apart from this national body, there are about six industry-wise bipartite committees at the national level which function under the general direction of the National Apex Body. Besides, each State has either set up a bipartite body or consultations between management and workers are carried out under the aegis of State Labour Advisory Boards.

While the national committee has been able to contribute substantially to the promotion of industrial peace, the one issue which has become a bone of contention between trade unions and employers is in regard to lay-offs and retrenchment of workmen and closures of units. While the labour accuses managements of deliberately resorting to these measures unilaterally, the managements defend their action by drawing attention to the recessionary conditions in certain sectors of industry. It is understood that the Government contemplates to enact legislation with a view to preventing unjustified lay-offs.

Employment generation

As one of the measures to increase employment opportunities for educated young people under the 20-point economic programme, the Central Apprenticeship Council of the Government of India met on July 31 and decided

ANNUAL REVIEWS

to fill up 40,000 existing vacancies under the Apprentices Act. The Committee also decided that 40 new trades should be designated under the Act mainly in the rural sector group of trades, women's occupations, leather, aeronautical, steel and ship-building industries, commercial trades, etc.

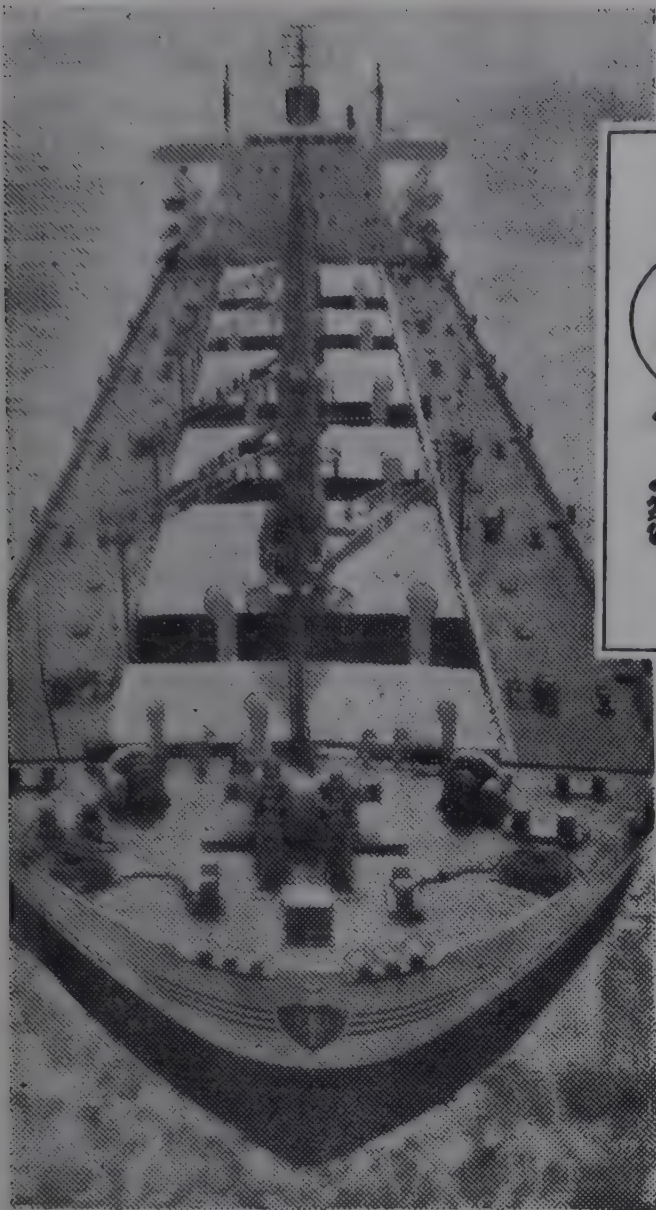
According to the Union Ministry of Labour, nearly 37,000 additional seats under the apprenticeship scheme had been filled up by October 1, taking the number of filled seats to a total of 1.06 lakh of the total 1.17 lakh seats located. The States have been asked to locate more seats, particularly in the 40 new trades approved for designation by the Central Apprenticeship Council.

Ceiling on dearness allowance

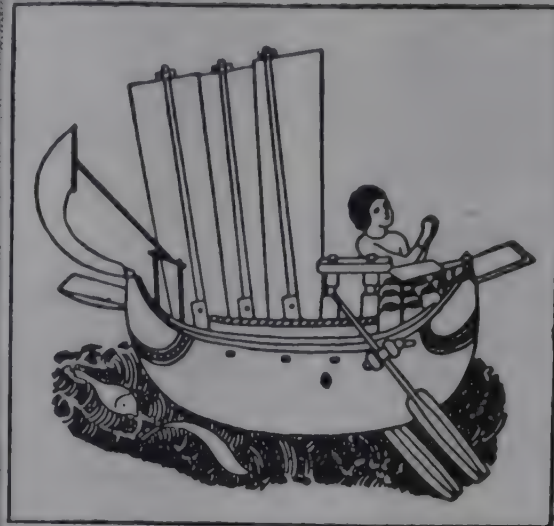
A question of considerable importance to industry in regard to the desirability of imposing a ceiling on dearness allowance has been decided by the Supreme Court. Delivering its judgment on May 2, 1975, in the appeal filed by Messrs Killick Nixon Limited v. Killick & Allied Companies Employees' Union, the Court decided that in spite of the financial capacity of the company (Killick Nixon) to pay dearness allowance without ceiling, there should be a ceiling in the company's (Killick Nixon) scheme of dearness allowance. The judgment arose out of an award given by the Industrial Tribunal, Maharashtra, that there should be no ceiling in the dearness allowance scheme of the company. While deciding this issue, the Tribunal had gone into the financial capacity of the company to pay dearness allowance without ceiling.

The Supreme Court in its judgment held that in considering the question of fixing a ceiling on dearness allowance, the financial capacity of the company alone is not the criterion and that even if a company was prosperous, ceiling on DA could be fixed particularly at the higher levels. The Court felt that though an employee was entitled to get the protection for his real wages from the soaring cost of living it was settled that complete neutralisation of the rise of the cost of living could not be allowed except to the lowest categories of employees.

The Court expressed the view that the question of imposition of a ceiling on



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was not an "absolutely alien phenomenon" in India. Although it is not a general practice, ceiling was rejected out of hand as "irrational and unjust" by unions in the course of collective bargaining in the Bombay region.

In its judgement, the Court stated that revision of DA was not the same thing as revision of wages. It, therefore, laid down 14 'factors' which could be taken into account by adjudicators in determining the issue of ceiling on DA. The Court, however, made it clear that so far as the lowest paid employees or those just above subsistence level were concerned, they were entitled to 100 per cent or any rate not less than 95 per cent neutralisation of rise in the cost of living. It ruled that there should, therefore, be no ceiling on dearness allowance payable to employees within a slab of first Rs 100, unless it could be shown by the management that the state of neutralisation in their case was more than 100 per cent.

So far as employees of the higher pay scales were concerned, the Court said that it would be for the tribunal to consider, having regard to the fourteen principles outlined by it, whether a ceiling should be imposed at any higher slab.

International women's year

In accordance with the decision taken by the United Nations to celebrate 1975 as the International Women's Year, the Union Ministry of Labour arranged a number of meetings, seminars, etc. with a view to focussing attention on improving the conditions of female labour in India. According to the 1971 census, out of the female population of 264 million, forming about 48.2 per cent of the total population, nearly 214 million, i.e. about 81.1 per cent belong to rural areas. Out of these as many as 27.97 million were recorded as workers who were engaged in some economic activity as their main occupation. Most of these women workers are found employed in large numbers in plantations such as tea, coffee, rubber, etc.

Among the legislative measures enacted by the Government to improve the economic conditions of women workers was the Equal Remuneration

Ordinance promulgated by the President on September 26. It provides for payment of equal remuneration to men and women workers and for prevention of discrimination on the ground of sex against women in the matter of employment.

The ordinance has been made applicable to plantation employees from October 15, 1975. As a result, about four lakh women employees in the plantation industry will get wages equal to those paid to men. The disparity in wages in tea plantations is the highest in Mandi (Himachal Pradesh—Re 1 per day), followed by Karnataka (60 paise per day), Tamil Nadu (55 to 56 paise per day), Kerala (40 paise per day), West Bengal (17 paise per day), Assam (18 paise per day) and Tripura (19 paise per day). The ordinance has been extended to women employees in local authorities, like municipalities, local boards, etc. with effect from December 31.

Maharashtra Government employees strike

The strike of 4.5 lakh Maharashtra Government employees was significant in many ways. That the Maharashtra Government Employees' Confederation could organise such a massive strike and continue it for thirty-seven days from 19th of April to 26th of May was itself unprecedented and spoke of the unity and solidarity of the State Government employees. The other unique feature of the strike was that the strike was peaceful and by and large free from outside political interference. The Confederation fought the strike on its own strength and showed rare skill and ability in controlling and directing lakhs of employees spread over the entire State. More importantly, the Confederation leaders were also able to secure active support of even gazetted officers of the State Government.

The Government of Maharashtra on its part showed great maturity, understanding and determination in dealing with the strike situation. Major credit in this regard must go to the new Chief Minister, Mr S. B. Chavan, who kept his head cool though he was beset with

ANNUAL REVIEWS

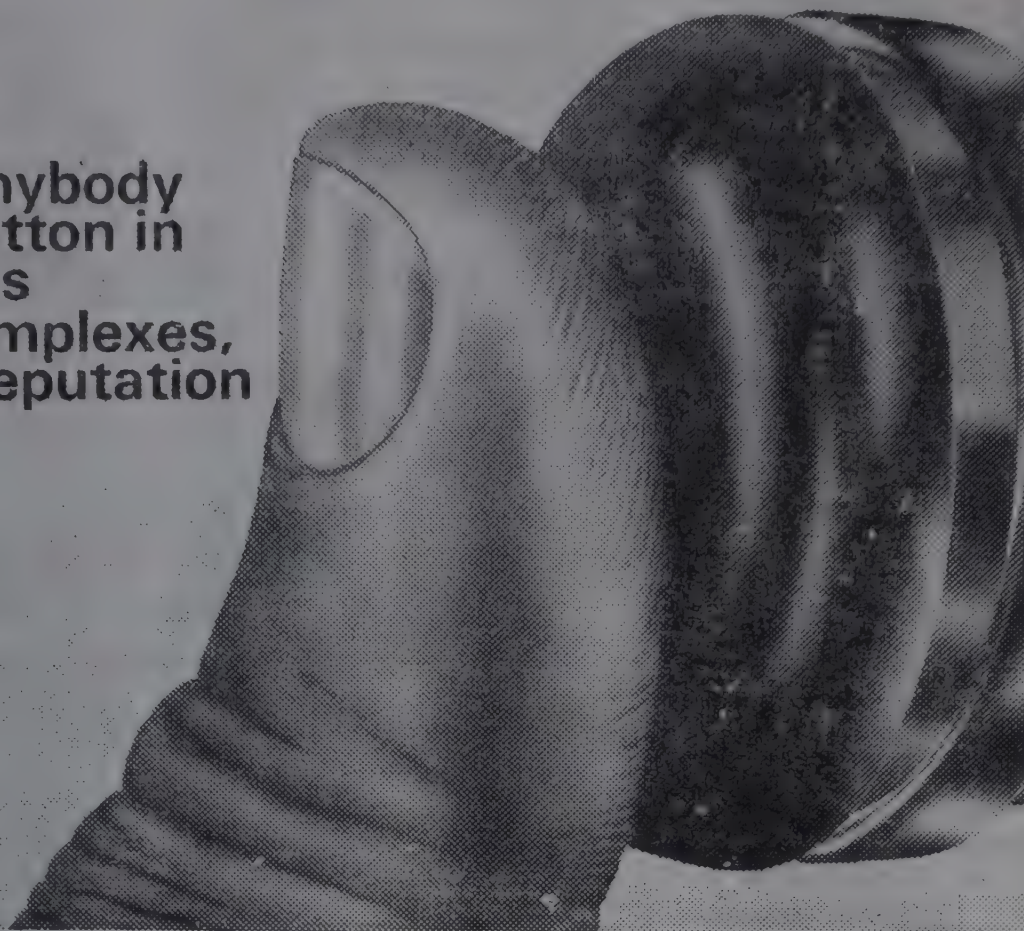
grave difficulties. He deserves unqualified praise for the tactful handling of the tricky situation. He did not wilt under the pressure of the striking employees and ultimately came out with greatly enhanced prestige.

The issue involved in the strike was simple. The Maharashtra Government Employees Confederation demanded parity of dearness allowance between the Central and State Government employees. It argued that if States like Gujarat, Rajasthan and Tamil Nadu could give to their employees dearness allowance at Central rates, there was no reason why the Maharashtra Government could not do the same thing. On facts and logic they had a strong case. The Chief Minister, however, maintained that in view of the limited resources of the State and the heavy commitments made in the budget for the Employment Guarantee Scheme, it was not possible for the Government to incur additional expenditure to the tune of Rs 75 crores and more as demanded by the employees. The result of the strike was a foregone conclusion. Once the Government decided to stand firm, the employees had no chance of success. The employees fought valiantly but they could not disturb the administration because the essential services were maintained and all the urgent matters were attended to.

The Chief Minister made an offer in early May of an increase in DA that would cost the State about Rs 35 crores a year. It was a great pity that the employees did not accept this offer and decided to continue the strike without properly assessing the staying power of the employees. Ultimately, as was to be expected, the employees had to give in. The terms of the agreement that was signed clearly show that the Confederation failed in its main demand and could not get anything more than what the Chief Minister had earlier offered.

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DURING 33 months between January 1972 and September 1974, the official average monthly wholesale price index showed a staggering increase of 73 per cent. What is significant, the seasonal rise in the prices which was traditionally observed after the kharif harvest was absent during this period.

Thereafter, a most remarkable and welcome reversal has taken place in the price trends (Table 1). But this was not a chance phenomenon. The proclamation of emergency on June 26, 1975 and a series of vigorous measures adopted by the government to slow down the expansion of bank credit and to immobilise the black money held by smugglers, tax evaders, hoarders and black marketeers paid a rich dividend in the form of falling prices.

There is little doubt that fiscal and monetary measures, particularly the latter, have made a significant impact on the price situation. During the 12-month period ended November 21, 1975, the money supply increased by 9.6 per cent, against 11.8 per cent and 18.4 per cent in the corresponding period of 1974 and 1973 respectively. While scarcity of bank credit has led to considerable piling up of inventories, the significant hike in lending rates has dealt a hard blow to speculators who had been ruthlessly exploiting shortages without any consideration for the consumer.

During the 12 months ended November 22, 1975, the official average monthly wholesale price index has been continuously falling except in April, May and August 1975 (Table 1). Thus, we have achieved a reasonable level of price stability in our country. There is one lesson to be learnt: India can have economic development with a reasonable level of price stability.

During the 12 months ended November 22, 1975, the official wholesale price index for 'all commodities' at 298.5 showed a welcome fall of 6.5

per cent. Unquestionably, this is the most satisfactory aspect of the current economic scene. In September 1974, with 30 per cent annual rate of inflation behind it, the country was on the brink of economic disaster.

As can be seen from Table 2, this fall in the prices was spearheaded by the decline in the wholesale price

index of food articles. Thanks to the bumper kharif harvest and the excellent rabi prospects, the prices of foodgrains in surplus producing States are tumbling down. Not only that, but the prices of groundnut oil and gur are also falling perceptibly. So, now our main worry is to check the steep fall in the prices of these commodities.

During October 1975—the fourth month in succession—the all-India

Table 1 : Index numbers of wholesale prices : 1961-62 to 1974-75

(Base : 1961-62 = 100)

Year/month (Average)	Food articles		Industrial raw materials		Manufactures		All commodities	
	Index	Variation (%)	Index	Variation (%)	Index	Variation (%)	Index	Variation (%)
1961-62	100.0	0.1	100.0	— 2.0	100.0	2.1	100.0	0.2
1962-63	106.5	6.5	97.8	— 2.2	102.6	2.6	103.8	3.8
1963-64	115.4	8.4	100.2	2.5	104.8	2.1	110.2	6.2
1964-65	135.4	17.3	115.9	15.7	109.0	4.0	122.3	11.0
1965-66	144.6	6.8	132.8	14.6	118.1	8.3	131.6	7.6
1966-67	171.1	18.3	158.4	19.3	127.5	8.0	149.9	13.9
1967-68	207.8	21.4	156.4	— 1.3	131.1	2.8	167.3	11.6
1968-69	196.9	— 5.3	157.3	0.6	132.7	1.2	165.4	— 1.1
1969-70	196.8	— 0.1	180.1	14.5	143.5	8.1	171.6	3.7
1970-71	203.9	3.6	197.3	9.6	154.9	7.9	181.1	5.5
1971-72	210.3	3.1	191.0	— 3.2	167.1	7.9	188.4	4.0
1972-73	239.5	13.9	204.0	6.8	176.7	5.7	207.1	9.9
1973-74	295.6	23.4	299.2	46.7	205.6	16.4	254.3	22.8
1974-75	363.6	23.0	327.2	9.4	254.5	23.8	313.7	23.4
1974								
October	381.7	— 1.0	330.4	— 7.1	261.5	+ 0.2	324.8	+ 1.1
November	375.6	— 1.6	320.1	— 3.1	256.7	— 1.8	320.0	— 1.5
December	369.7	— 1.6	320.7	+ 0.2	255.4	— 0.5	317.2	— 0.9
1975								
January	368.5	— 0.3	316.4	— 1.4	254.0	— 0.5	315.8	— 0.4
February	365.3	— 0.9	306.4	— 3.2	255.2	+ 0.5	313.5	— 0.7
March	357.7	— 2.1	292.9	— 4.4	253.3	— 0.7	308.4	— 1.6
April	361.1	+ 1.0	286.2	— 2.3	252.0	— 0.5	308.6	+ 0.1
May	371.2	+ 2.8	286.7	+ 0.2	251.9	—	313.1	+ 1.5
June	370.1	— 0.3	282.9	— 1.3	251.5	— 0.2	312.2	— 0.3
July	361.1	— 2.4	273.5	— 3.3	252.1	+ 0.2	309.2	— 1.0
August	364.6	+ 1.0	281.0	+ 2.7	252.1	—	311.5	+ 0.7
September	362.4	— 0.6	268.5	— 4.4	253.0	+ 0.4	309.5	— 0.7
October	361.8	— 0.2	260.2	— 3.1	253.3	+ 0.1	308.0	— 0.5
Percentage variation between Oct. 1974 and Oct. 1975 ..								
		— 5.2		— 21.2		— 3.1		— 5.2

ANNUAL REVIEWS

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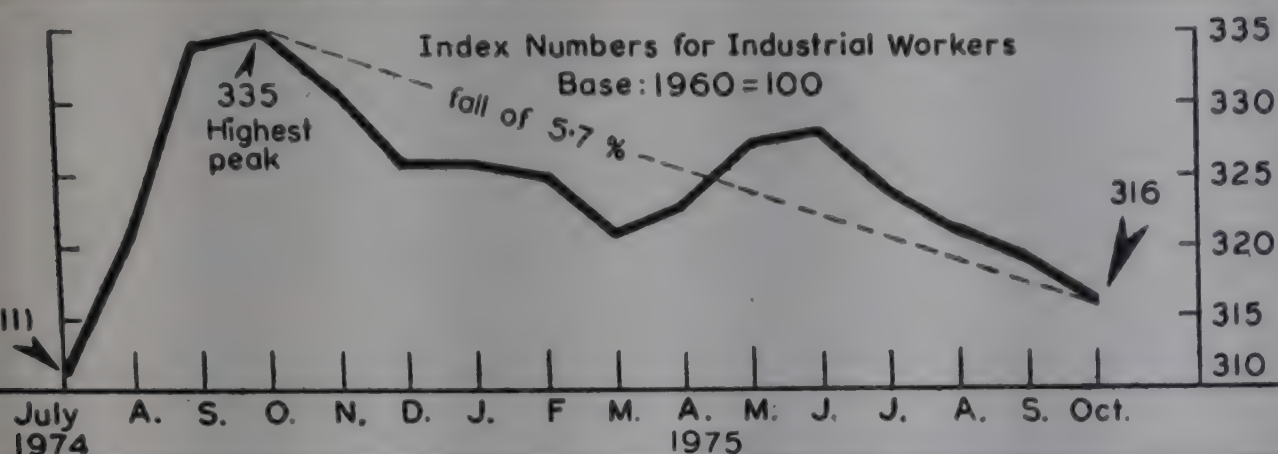
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Trends in Consumer Price Index



Consumer price index number continued to decline. Between July and October 1975, the index declined by 7 per cent. Thus, the decline in prices which was confined earlier to the wholesale level has now percolated to the retail level also. For the first time during the past six years or so, the consumer price index has shown such a decline over a 12-month period on a point-to-point basis. As compared to the peak level of 1974, this index is lower by 5.7 per cent. With this dec-

line, any additional increase in the dearness allowance to government employees is unlikely in the immediate future. This will considerably ease the pressure on the government finances.

This impressive achievement on the price front is all the more heartening, when viewed in the context of the fact that most non-communist countries continue to record severe inflation during the latest 12 months (e.g., the UK 27 per cent and Japan 11 per cent).

Table 2 : Group-wise index number of wholesale prices

(Base 1961-62 = 100)

Group	Weight	Index number		Percentage variation over the year
		November 23, 1974	November 22, 1975	
Food articles	41.3	374.2	339.7	- 9.2
Liquor and tobacco	2.5	310.4	321.6	+ 3.6
Fuel, Power etc.	6.1	318.6	351.8	+10.4
Industrial raw materials	12.1	320.8	—	—
Chemicals	0.7	309.4	323.7	+ 4.6
Machinery and transport equipment	7.9	269.1	263.3	- 2.2
Manufactures	29.4	255.8	252.8	- 1.2
All commodities	100.0	319.2	298.5	-6.5

MONEY AND BANKING

Money supply expansion 10.5 per cent

By COMMERCE RESEARCH BUREAU

THE commercial banks in the country handled a larger volume of business as reflected in their inflow and outflow of funds during the 12 months ended November 28, 1975 as compared to the preceding 12 months. Table 1 gives the details of the flow of funds.

At Rs 2,117 crores, the flow of funds during 1975 was 20 per cent larger than that in the preceding year. The accretion of Rs 1,923 crores in aggregate

deposits came in handy for the banks to finance the credit expansion of Rs 1,689 crores. Of the deposits accretion of Rs 1,923 crores, as much as Rs 1,340 crores or 70 per cent accrued to the banks during April-end and November-end 1975.

Advances to priority sectors

There was a spurt in the advances to the priority sectors by the public

ANNUAL REVIEWS

sector banks immediately after the nationalisation of the 14 major banks in July 1969. As Table 2 shows, the share of priority sector advances in the total advances of the public sector banks amounted to 58 per cent between June-end 1969 and June-end 1970. Thereafter, the share remained stagnant at 28 per cent during the successive three years. During the year ended June 1974, these sectors received a little more attention when their share in the total advances rose to 35 per cent.

However, the year ended December 1974 showed significant improvement over the figures for June 1971, although it could not reach anywhere near the position attained by the banks in this respect during the year ended June 1970.

Branch expansion

The commercial banks opened as many as 1,794 branches during the year ended June 1975, as against 1,574 branches during the previous year ended June 1974. Of the 1,794 new branches opened in 1975, 641 branches or 36 per cent were in rural areas. In the previous year ended June 1974, the percentage worked out to 38.

Trends in money supply

Although there was an increase of Rs 258 crores in net bank credit extension to the Government sector during the year ended October 1975 as compared to the preceding 12 months, the money supply expansion during the latest year at 10.5 per cent was a shade less than that of 10.8 per cent witnessed in the previous year ended October 1974. This was mainly due to the increase in the non-monetary liabilities (especially time deposits with banks) of the banking sector.

The major contributory factor to the money supply expansion in 1975 as well as in 1974 was bank credit to the commercial sector. But for the increase in the non-monetary liabilities of the banking sector, the inflationary impact of credit expansion during 1975 and 1974 would have been higher. Anyway, it is thus clear that despite all credit curbs, expansion of bank credit has been quite large.

During the three weeks ended November 21, 1975, money supply fur-

ANNUAL REVIEWS

ther expanded by Rs 83 crores to Rs 12,239 crores.

Busy season of 1974-75

The busy season of 1974-75 witnessed a lower pace of credit expansion by scheduled commercial banks as compared with the previous busy season. Between October-end 1974 and April-end 1975, bank credit expanded by Rs 950 crores (12.4 per cent) as against an expansion of Rs 1,111 crores (17.1 per cent) in the corresponding period of 1973-74. The credit expansion including bills rediscounted with the Reserve Bank at Rs 1,009 crores (12.9 per cent) was also lower than that in the previous busy season (Rs 1,355 crores or 20.7 per cent).

1975 slack season trends

But, during the 1975 slack season (i.e., between April 25 and October 24, 1975), the contra-seasonal credit expansion (including bills) was significantly higher at Rs 664 crores (7.7 per cent) against the contra-seasonal expansion of Rs 128 crores (1.7 per cent) during the slack season of 1974. The overall credit expansion during the year ended October 31, 1975 thus worked out to 20 per cent which was one percentage point higher than that in the corresponding period a year ago.

Busy season policy: 1975-76

It is in the context of the above that the Reserve Bank Governor announced on November 1, 1975 the busy season credit policy for 1975-76. Tracing the background of the current economic situation in the country, he cautioned that the overall economic situation could not be viewed with complacency and that the efforts to sustain growth and stimulate investment did not cause the economy to move towards a fresh bout of inflation.

The following are the basic features of the 1975-76 busy season credit policy announced by the Governor of the Reserve Bank of India.

Table 1 : Flow of funds through the scheduled commercial banks

(Rs crores)

		Year ended November 29, 1974		Year ended November 28, 1973	
		Sources	Uses	Sources	Uses
Aggregate deposits	.. .. .	1,519	—	1,923	—
Borrowings from RBI	.. .. .	—	46	113	—
Balances with RBI	.. .. .	186	—	81	—
Bank credit	.. .. .	—	1,085	—	1,689
Investments in Government securities	.. .. .	—	459	—	338
Cash	.. .. .	—	24	—	25
Balances with other banks in current account and money at call and short notice	.. .. .	56	—	—	55
Unspecified	.. .. .	—	147	—	10
Total	.. .. .	1,761	1,761	2,117	2,117

Table 2: Increase in public sector banks' advances to priority sectors: 1970 to 1974

(Rs crores)

Advances to		During the year ended the last Friday of					
		June 1970	June 1971	June 1972	June 1973	June 1974	December 1974
A. Agriculture (i + ii)	.. .. .	139	39	48	80	116	159
(i) Direct finance	.. .. .	120	46	26	66	94	110
(ii) Indirect finance	.. .. .	19	—7	22	14	22	49
B. Small-scale industries	.. .. .	118	73	85	118	223	143
C. Other priority sectors (including retail trade)	.. .. .	70	27	19	39	52	30
I. Total advances to priority sectors (A + B + C)	.. .. .	327	139	152	237	391	332
II. Total advances to all sectors	.. .. .	561	502	542	808	1,133	751
III. I as per cent of II	.. .. .	58	28	28	29	35	44

Table 3 : Offices of commercial banks in India

At the end of		No. of branches	Increase over the preceding period indicated		New branches opened in rural areas as per cent of total
			Total	In rural areas	
June	1969	.. .. .	8,262	—	—
December	1969	.. .. .	9,051	789	445
December	1970	.. .. .	11,184	2,133	1,489
December	1971	.. .. .	12,985	1,801	1,123
December	1972	.. .. .	14,739	1,754	436
December	1973	.. .. .	16,503	1,764	698
December	1974	.. .. .	18,180	1,677	608
June	1975	.. .. .	18,730	550	175
Total	.. .. .	—	10,468	4,974	48

ANNUAL REVIEWS



(v) The system of levying the commitment charge of one per cent on the unutilised portion of cash credit has been withdrawn.

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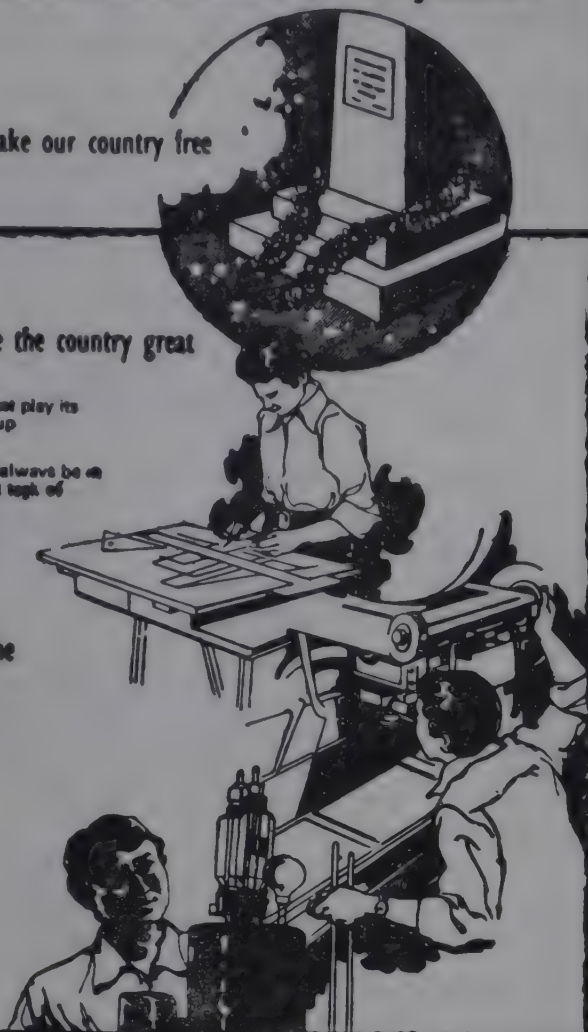
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FOREIGN TRADE AND FOREIGN AID : 1975

Widening trade gap

COMMERCE RESEARCH BUREAU

DIA began the year 1975-76 with a legacy of a record trade deficit of Rs 1,164 crores in 1974-75. Total exports during 1974-75 at Rs 3,304 crores represented a 31 per cent increase over exports in the preceding year and the increase was in conformity with the impressive growth of exports during 1972-73 and 1973-74. But this increase in exports was more than offset by a larger increase in imports: the imports rose by 51 per cent to reach Rs 4,468 crores, resulting in the deficit of Rs 1,164 crores.

The international price boom dominated our foreign trade in 1974-75. Almost all the major export items fetched higher unit values during the latter part of 1974-75. Higher earnings from sugar, textiles, tea, cashew kernels were due more to the higher unit prices than an increase in the quantum of exports.

The world boom in prices had, however, its simultaneous and much greater impact on our import bill. The upsurge in world prices imposed a heavy burden in the way of additional cost. The three items, namely crude petroleum and products (Rs 1,157 crores), foodgrains (Rs 758 crores) and fertilisers (Rs 425 crores) accounted for 52 per cent of the total imports during 1974-75. Other items like iron and steel, non-ferrous metals, chemical elements and compounds were also responsible for the rise in the import bill.

India's foreign trade during the first six months of the current fiscal year was marked by a mounting trade deficit from month to month culminating in the trade deficit of Rs 183 crores in September 1975, which was the highest for a single month during the current year. Exports during the six months April to September 1975 were Rs 1,732 crores, showing 14 per cent rise over the exports of Rs 1,515 crores in the corresponding period of 1974. But the imports during April-September 1975 rose faster by 22 per cent and totalled Rs 2,361 crores. Consequently, the deficit amounted to Rs 629 crores during April-September 1975 as against Rs 418 crores during the same period of 1974.

With the current recession in industrialised countries and the fall in world prices our exports are not enjoying the higher unit value realisation during

current year, which characterised the exports during last two years. The Indian Institute of Foreign Trade has estimated that the average unit value of our exports would decline by 5.6 per cent in 1975-76 over that of 1974-75.

The Government has taken a series of steps to raise exports of selected major items so as to attain a growth rate of 10-12 per cent in the current year. A large number of incentives are announced and export procedures are simplified.

These measures include delicensing of about 190 items of exports, exemption from duty for raw materials imported against advance licences subject to export obligation, liberalisation of import replenishment scheme, removal of export duty on certain items, simplification of disbursal procedures for cash assistance, extension of cash support to several non-traditional and traditional items and liberalisation of export credit.

For certain export items, specific incentives have been provided. The incentives for engineering goods include protection to registered export contracts for three years in the case of capital goods and for entire duration in the case of turnkey contracts, concessional rate of pre-shipment credit, supply of raw materials, power, and export finance on a priority basis to exporters. For jute manufactures the export duty on hessian and carpet backing is abolished and compensatory support of 10 per cent of the f.o.b. value of the exports is provided.

Trade agreements and protocols signed by India with Hungary, East Germany, Czechoslovakia, Poland, Italy

Exports of major items: 1975-76

(Rs crores)

Item	Target for full year	Actual exports (Apr. to Oct.)	
		1974-75	1975-76
Sugar	450	118	N.A.
Engineering goods ..	400	89*	138*
Cotton textiles ..	300	179	109
Jute manufactures ..	250	188	N.A.
Tea	240	35†	39†
Iron ore	196	47†	72†
Leather and leather manufactures ..	175	92	107
Basic chemicals, pharmaceuticals and soaps	137	65**	38**
Gems and jewellery	125	46**	56**
Tobacco, unmanufactured ..	107	32†	42†
Cashew kernels ..	95	76	59
Chemicals and allied products	82	43**	32**
Wool and woollen textiles	74	43††	40††

* April to August

** April to September

† April to June

‡ April to November

and Afghanistan during the current year envisage enlarged two-way trade between India and these countries. The full impact of these agreements would, however, be felt in 1976-77.

Among our major export items, exports of engineering goods in the first five months ended August of the current fiscal year, were of the order of Rs 138 crores compared with Rs 89 crores during the corresponding period of last year. Engineering exports are likely to reach an all-time record of Rs 650 crores during the current fiscal year.

Even though sugar export is no longer as lucrative as in 1974-75, the target for the current year is Rs 450 crores. Out of 13 lakh tonnes of sugar to be exported in the current year, contracts for nearly 11 lakh tonnes were signed by the STC and about 8 lakh tonnes were shipped till October-end.

Recent trends in India's foreign trade

(Rs crores)

Year/month	Imports		Exports		Trade balance
	Amount	Percentage change	Amount	Percentage change	
1970-71	1,634	3.3	1,535	8.6	— 99
1971-72	1,824	11.6	1,608	4.8	— 216
1972-73	1,868	2.4	1,971	22.6	+ 103
1973-74	2,955	58.3	2,523	28.0	— 432
1974-75	4,468	51.2	3,304	31.0	— 1,164
April to September					
1974	1,933		1,515		— 418
1975	2,361	22.1	1,732	14.3	— 629

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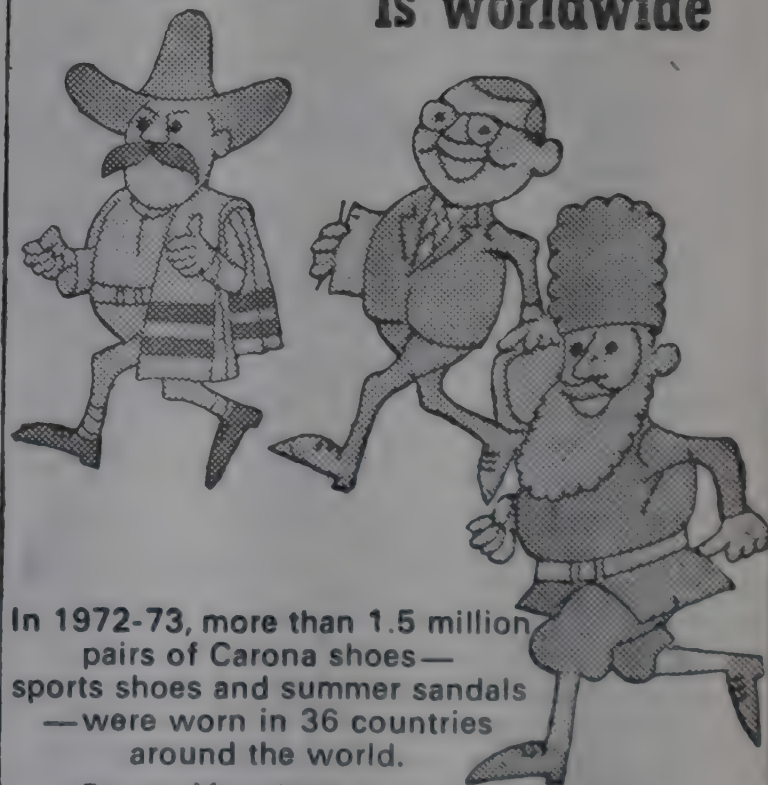
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Export earnings from tea are expected to go up by about Rs 20 crores over the previous year's all-time record of Rs 224 crores. Exports during the first quarter of the current year amounted to Rs 39 crores against Rs 35 crores in the corresponding period of 1974-75.

Despite the efforts to make a breakthrough in iron-ore exports to Western Europe and oil-rich countries, the iron-ore exports by MMITC during the eight months ended November 21, 1975 were of the order of Rs 72 crores against the annual target of Rs 196 crores. The main reason for this shortfall was the reduced demand caused by recession in the world steel industry.

The exports of cotton textiles were adversely affected by the slackened demand due to continued recessionary trends in the developed countries. As against the exports of Rs 179 crores in April-October 1974, the exports of cotton textiles fetched only Rs 109 crores during the same period of 1975. Cotton piecegoods and yarn fared very badly. Fulfilment of the export target of Rs 300 crores set for current fiscal year appears to be highly doubtful.

Notwithstanding the package of incentives provided by the Government, the exports of jute manufactures have not picked up. Exports during April-September 1975 at 2.33 lakh tonnes were far short of 3.54 lakh tonnes shipped during April-September 1974 and the gap of over one lakh tonnes is unlikely

to be bridged during the remaining period of the current year. The Bangladesh jute goods, backed by Taka devaluation, enjoy an edge over Indian goods. India's export earnings from jute goods in 1975-76 are likely to drop to Rs 245 crores from Rs 296 crores in 1974-75.

On the import front, the prices in international market of some major items like foodgrains, fertilisers and some of the non-ferrous metals have come down. The international price of fertilisers crashed from \$450 to \$140 per tonne for some categories during May and October 1975.

During the current year, despite bountiful rainfall and record food production, the Government intends to build up a sizable buffer stock and imports of about five million tonnes of foodgrains are envisaged for this purpose. But in view of the falling prices of foodgrains in world market, the import bill is likely to be less than Rs 758 crores last year.

A substantial increase in indigenous production of fertilisers prompted the Government to ban in August 1975 the new import contracts for fertilisers till the end of the year. Further, the decline in international prices of fertilisers has enabled the Government to renegotiate the prices of fertilisers already contracted. India is expected to save nearly Rs 110 crores in the current year on this account.

ANNUAL REVIEWS

Steel imports are being restricted to special varieties such as high carbon sheets. With likely steel exports of Rs 100 crores, India is poised to have net earnings of Rs 10 crores in respect of this item in the current year.

But the 10 per cent increase in crude oil prices announced by the OPEC, effective from October 1, 1975, means an additional annual expenditure of about Rs 108 crores in foreign exchange. Another factor, which has worsened the situation is the appreciable hardening of the dollar in recent months. Taking these two factors into consideration, the total import bill of crude petroleum and petroleum products is likely to be of the order of Rs 1,250 crores in 1975-76 against Rs 1,157 crores in last year.

In the light of the trends during the first six months of the current fiscal year, it appears that our exports would rise to Rs 3,800 crores while imports would be in the neighbourhood of Rs 5,300 crores. As a result the trade gap would be of the order of Rs 1,500 crores.

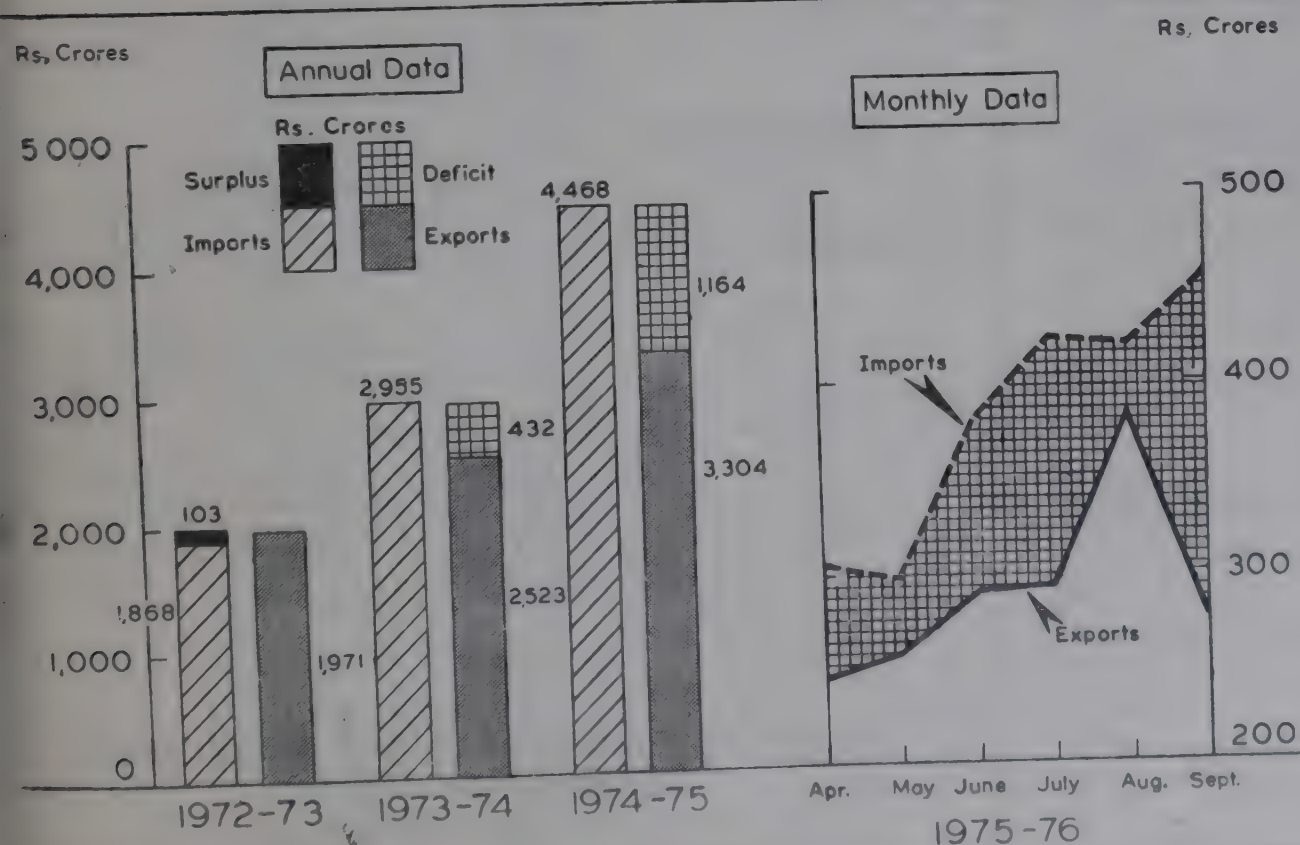
Foreign aid

The external aid authorised to India till the end of March 1975 totalled Rs 13,984 crores. Out of this, the aid authorised during 1974-75 is provisionally placed at Rs 1,281 crores. The World Bank Group has continued to be the largest donor. By the end of March 1975, the Group had advanced Rs 3,060 crores, accounting for 22 per cent of the aid received by India from all sources. In 1974-75, its share in the total aid received by India was 51 per cent.

External assistance in the last few years has been characterised by mounting debt service charges and reduced net inflow of aid. The total debt service as per cent of the gross aid utilised has more than doubled from 27 per cent in 1961-62 to 56 per cent in 1974-75. During 1974-75, the net inflow of resources amounted to Rs 479 crores out of Rs 1,081 crores of aid utilised.

During the current year, the Aid-India Consortium which met in June 1975, pledged assistance of \$1,075 million (Rs 806 crores) to India. Inclusive of \$700 million (Rs 525 crores) promised by the World Bank Group, the total pledge for 1975-76 aggregated \$1,775 million (Rs 1,331 crores). Of this total pledge, non-project aid is expected to be \$1,085 million (Rs 814 crores) or 61

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cent and the rest would be project
tance.

The external assistance authorised
India during April to the middle of
ember 1975 amounted to Rs 1,414
es. Out of this, Iran, which is not a
sortium member, has provided
563 crores. The UK has been the
t largest donor, advancing Rs 234
res. The US has not made any com-
ment so far this year.

**Aid agreements signed during April to
mid-December 1975**

(Rs crores)				
Country/Institution				
Amount				
Iran	..	..	..	563
UK	..	..	..	234
World Bank Group	..	..	..	167
West Germany	..	..	..	156
Sweden	..	..	..	114
Japan	..	..	..	71
Canada	..	..	..	56
World food programme	..	..	..	22
Belgium	..	..	..	8
IFC	..	..	..	7
USSR	..	..	..	6
Norway	..	..	..	6
Netherlands	..	..	..	3
Denmark	..	..	..	1
Total	..	..	..	1,414

A heartening development in the
current year has been the liberalised
rms of aid. The World Bank has
reed that aid flows should be
ade smoother and more attuned to
e needs of the economy. The UK
as decided to give all aid as grant
countries with per capita income
less than \$200 and India has
een one of the major beneficiaries.
apan has decided to reduce the inter-
est rate for non-project assistance from
per cent to 3.5 per cent. Sweden has
romised to increase the grant compo-
nent.

As regards the future prospects, the
redits totalling \$684 million from the
DA are likely to be approved by the
end of March 1976. They would include
\$105 million for the fertiliser industry,
\$150 million for power transmission,
\$22 million for two agricultural projects
and \$200 million for industrial inputs.
Kuwait is likely to provide aid of
Rs 45 crores for the Kalinadi hydro-
electric project in Karnataka. Saudi
Arabia has also agreed to provide as-
sistance for Srisailam and Nagarjuna-
sagar power projects. Iranian assistance
is expected to be available for Rajasthan
Canal Command Area project and a
fertiliser factory at Paradip.

Inclusive of aid from communist
countries and oil exporting countries,
total gross external assistance in 1975-
76 is expected to be of the order of
Rs 1,900 crores. The net aid may be
about one-third of this figure

Foreign exchange reserves

The reserves, excluding gold, which
stood at Rs 826 crores by the end of
April 1975, declined to Rs 724 crores by
July end. To augment the foreign ex-
change reserves, India drew in August
201 million SDRs (Rs 212 crores) under
oil facility, out of India's total entitle-
ment of 670 million SDRs under 1975 oil
facility. A steady rising trend in reser-
ves was observed since then till the end
of November.

An increase in earnings from
invisibles in recent months has been

India's foreign exchange reserves

(Rs crores)				
End of				
Reserves (excluding gold)				
1970-71	..	..	..	550
1971-72	..	..	..	666
1972-73	..	..	..	664
1973-74	..	..	..	764
1974-75	..	..	..	787
1975	..	..	..	..
April	..	..	..	826
May	..	..	..	754
June	..	..	..	708
July	..	..	..	724
August	..	..	..	906
September	..	..	..	986
October	..	..	..	1,078
November	..	..	..	1,108

COTTON TEXTILES

Lower production, higher stockpiles

By BHASKAR G. KAKATKAR

THE cotton textile industry experienc-
ed difficult trading conditions in
1975. The demand for cloth remained
poor during most part of the year and
the mills had to nurse large stocks of
yarn and cloth. Exports too were slack,
due to continuing recession in the
world textile markets.

Prolonged large power cuts in the
first half of the year under review in
almost all textile centres had an adverse
effect on production. Although several

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of the Indian Cotton Mills' Federation.*

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one of the major contributory
factors for the comfortable posi-
tion of reserves. Between January
and August this year, the in-
come from invisibles amounted to
Rs 570 crores against Rs 330 crores in
the corresponding period of last year.
India's earnings from invisibles are
likely to touch about Rs 1,000 crores in
the current year. The main reason for
the buoyancy of receipts from invisibles
was the shrinkage of the black market
premium on currencies like dollar and
pound, as a result of a crackdown on
smugglers and successful tackling of in-
flation. Inflow from abroad has further
spurred in recent months following the
Finance Minister's drive to attract funds
from Indians abroad and aliens of In-
dian origin.

As at the end of November, the re-
serves, excluding gold, stood at Rs 1,108
crores, despite the rising trade deficit
from month to month this year. Even
after discounting the IMF drawal in
August, the reserves as at the end of
November were higher than at the be-
ginning of the current financial year.

In addition to existing aid-giving
agencies, other sources of aid like
"Third Window" and 1-billion-dollar
fund created by the oil exporting
countries for giving aid to countries
hit by oil crisis are expected to be estab-
lished. These will start functioning from
the new year.

mills had installed diesel power gene-
rating equipment, electricity production
out of these sets could not fully make
good the loss of power from the public
grid. The return of normalcy in
power supply in the second half of the
year was again marred by intensifica-
tion of power cut in Maharashtra from
December 16. Thus the drop in yarn
and cloth output suffered in the first
half of the year could be offset only
very partially. Consequently, the
comfortable supply of cotton was not
of much avail.

When a rolling stone gathers moss



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The big fall in cotton prices from peak levels of 1974 no doubt gave some relief to the mills from the pressure of cost inflation. But this did not impart any profitability to the industry as the mills had to cut the prices of their manufactures even more drastically in an attempt to reduce their stocks. Ex-mill prices of cotton yarn had dropped so low that, in the last few months of 1975, they were around December 1971 levels. This has made the plight of the yarn sector miserable that its continued working has become a serious problem. Mill-made cloth prices (ex-mill) were also down by 15 to 30 per cent from those of the year before.

The anti-inflationary measures and the drive against hoarders and black marketeers engendered a large measure of caution among the traders, and the speculators who used to finance the cloth and yarn trade were out of the market. Bank credit was scarce and, what was more, had become extremely expensive. Normal trade channels, therefore, lifted cloth and yarn only on a hand-to-mouth basis.

Controlled cloth

On top of all this, the composite mills had to suffer heavy losses on the controlled cloth, the obligation in respect of which continued to be at the high rate of 800 million sq metres a year since April, 1974. Because of the sluggish demand for non-controlled cloth, it was not possible for mills to recover the loss on controlled cloth by raising the prices of non-controlled varieties. Towards the close of the year Government decided to exempt NTC mills from the obligation to manufacture controlled cloth, as also those loss-making mills in the private sector which have exhausted their reserves.

All through the year, the industry tried to convince the Government of the need for a rational policy in regard to controlled cloth. It had nearly succeeded, for, on July 18, 1975, the Commerce Minister had publicly stated at a press conference in Bombay that the price of controlled cloth would be raised so as to enable the industry to recover the cost of making controlled cloth. But this scheme was shelved and a committee under the chairmanship of Mr Marathe, the chairman of the Bureau of Industrial Costs and Prices, has been set up to go into the cost aspect of controlled cloth.

Production

Now for some data about the industry's performance in 1975. As at

the time of writing, production statistics are available for only 11 months January-November, of which the figures for the last four months are provisional. During these 11 months, production of cotton yarn was 896 million kg as against 920 million kg in the same period of 1974. The estimate for 1975 as a whole may be placed at 980 million kg which is some 2.6 per cent lower than 1,007 million kg spun in 1974.

Cloth production in the mill-sector, which accounts for only a little more than 50 per cent of total production in the country, was 3,750 million metres in January-November, as against 3,935 million metres in the same period of 1974. For 1975 as a whole, it may be placed at 4,100 million metres, a drop of some 5 per cent as compared with the preceding year's figure of 4,316 million metres. Indeed, mill cloth production in 1975 was the lowest since 1971 when it had touched 3,957 million metres.

As usual, the data on the performance of handlooms and powerlooms (the decentralised sector) lag far behind. As of now, they are available for the first half of 1975 only and those for the subsequent three months are very provisional estimates. According to these, cloth production in the decentralised sector in January-September 1975 works out to 2,866 million metres, as compared with 2,992 million metres during the corresponding period of 1974. On this basis, handloom and powerloom cloth production for 1975 as a whole may be placed at 3,800 million metres, that is, 168 million metres or 4 per cent lower than in the previous year.

Thus, total cotton cloth production in 1975 amounts to 7,900 million metres in round figures, as compared with 8,284 million metres in 1974 and 7,771 million metres in 1973. In other words, cloth output in the year that is just over might be down by about 400 million metres.

Exports

The decline in availability of cloth for domestic consumption, however, was of a smaller magnitude because of the fall in exports. Shipments of piecegoods alone during January-November 1975 were down by 190 million metres at 238 million metres. As apparel exports were just about maintained, there was no question of more cloth having been exported in the form of garments. On the whole, exports were lower by 32 per cent, as

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compared with the previous year, as will be seen from Table 1.

Table 1 : Exports of mill-made cotton textiles (January-November)

(Value in crores of rupees)

	1975	1974	1973
Piecegoods	73.73	145.49	119.14
Yarn	4.62	16.92	12.13
Apparels	90.80	84.80	40.52
Hosiery	2.73	5.00	1.45
Other cotton manufactures ..	30.00	44.22	23.31
Total ..	201.88	296.43	196.55

The decline in exports of cotton textiles is a reflection of continuing recession in the world markets, the worst to be witnessed since the second world war. There was an appreciable drop in the unit value realised; in the case of piecegoods, for instance, the unit value realisation in November 1975 was as low as Rs 2.81 as compared with Rs 3.69 a year before and Rs 3.86 in September 1974.

Despite lower production, stocks of cloth with the mills at the end of November 1975 were higher at 423 million metres, as against 385 million metres at the close of 1974. Similarly, stocks of yarn were also larger by 6 million kg at 23 million kg. Such large stocks, coupled with erosion of liquid resources on account of losses suffered during the major part of the year, posed a serious problem of working capital for the vast majority of mills.

Even at the end of 1975 there were no signs of revival of activity in the yarn and cloth markets. As already stated, the question of revising the prices of controlled cloth has been referred to the Marathe Committee and one is not certain how long that committee will take to submit its recommendations. Meanwhile, prices of cotton have started rising once again; they have already moved up by Rs 250 to Rs 600 per candy; indeed, good quality Sankar 4 has shot up from Rs 4,000 in September 1975 to 5,200 per candy. This price increase has made the working of the industry even more uneconomic than what it has been. Thus the New Year does not begin well for the cotton textile industry.

SUGAR

Industry suffers losses despite record output

By AN INDUSTRIAL CORRESPONDENT

THE sugar season 1974-75 has ended up with an all-time record sugar production of 47.94 lakh tonnes representing an increase of 21 per cent over the previous season's production of 39.5 lakh tonnes. Initially, at the beginning of the season, the production was estimated at a much lower figure between 40 lakh and 42 lakh tonnes. But as the season progressed, following timely and adequate winter rains, there was substantial improvement in the cane yields and the condition of the crop generally. With comparatively much higher cane prices offered by the factories, the diversion of cane to gur and khandsari was effectively checked. The levy on khandsari in UP by the State Government also helped to increase the output to reach an all-time record level of 47.94 lakh tonnes. The increase in production has been the contribution of almost all the sugar-producing States except Tamil Nadu and Bihar. While in Tamil Nadu the cane crop had suffered due to serious drought conditions, in Bihar recurring floods had damaged the cane crop.

Table 1 gives the regionwise figures of sugar production during the season 1974-75.

Table 1: Regionwise figures of sugar production — 1974-75 season

Region	Sugar production (lakh tonnes)
West Bengal	0.10
Bihar	2.12
East Uttar Pradesh	3.28
West Uttar Pradesh	4.96
Central Uttar Pradesh	6.07
Whole Uttar Pradesh	14.31
Gujarat	1.61
Maharashtra	15.15
Punjab	0.77
Haryana	1.14
Tamil Nadu	3.84
Andhra Pradesh	3.97
Orissa	0.13
Madhya Pradesh	0.57
Kerala	0.18
Karnataka	3.37
Rajasthan	0.30
Pondicherry	0.24
Assam	0.07
Goa	0.04
Nagaland	0.03
All India	47.94

Increased cost of production

The record sugar production indicated above could be achieved by the industry only by incurring much higher costs. While mills in Central and Western UP had paid a price of Rs 14-50 per quintal of cane, those in East UP and Bihar had paid Rs 13-50 per quintal, as against the notified statutory cane price of Rs 8.50 per quintal. The mills in other regions have also paid substantially higher prices for cane which accounts for 70 to 75 per cent of the production costs. The additional cane payments have been about Rs 225 crores or nearly 50 per cent more than the statutory cane price fixed for the season 1974-75. Apart from this, there has been a substantial increase in the quantum of cane cess/purchase tax levied by the various State Governments, ranging from 60 to 100 per cent. Further, wages had gone up by 80 per cent, interest charges by 60 to 70 per cent and cost of all essential stores by about 70 per cent. All these have pushed up the production costs.

Industry suffers heavy losses

While the industry performed creditably in the matter of sugar production and capacity utilisation even to the extent of 109 per cent of the installed capacity of 44 lakh tonnes excluding new units which had only a trial run, by incurring much higher costs the industry had to suffer serious losses, as it had to operate under a highly uneconomic price structure. The price structure in the sugar industry consists of two components namely the levy price which is highly subsidised and at which the Government procures 65 per cent of the output for distribution through controlled channels, and free sugar representing the balance 35 per cent, the price of which the Government regulates through monthly releases. These two together constitute the price structure for the industry under the policy of partial control being followed since 1967-68.

In order to maintain a uniform issue price of levy sugar throughout

the country at Rs 215 per quintal which remains unchanged since December 1972, the Government has regarded various cost increases in computing the levy prices. The incidence of all these works out to about Rs 10 per quintal of sugar. On free sugar consisting 35 per cent of production, this works out to about Rs 42 per quintal. The Government has assumed average free sugar realisation of Rs 322 per quintal while revising levy prices. If we add to the above figure, the short-fall of Rs 42 per quintal, the total comes to Rs 364 which the factories should realise against this, the actual average sugar realisations by the factories during 1974-75 season have been Rs 308 per quintal, leaving a deficit of about Rs 56 per quintal of sugar.

Heavy excise duty on free sugar

The main factor for lower factory free sugar realisation has been the disproportionately high incidence of excise duty. It may be recalled here that in the last Union Budget the Government had increased the excise duty on free sugar from 37.5 to 43 per cent *ad valorem*, with a view to curbing the consumption of sugar in the country thereby making available large quantities of sugar for exports. The incidence of the excise, therefore, amounts to as high as Rs 135 per quintal, or Rs 1.35 per kg on free sugar. However, the consumption and price trends within the country have clearly indicated that the industry was in a position to bear such a high incidence of excise duty on free sugar. Repeated representations made by the industry to the Government for an appropriate reduction in the duty have so far gone with no result. The high excise duty has cut into the realisations of the factories. As a result, the industry suffered severe losses and it is estimated that 75 to 80 per cent of the factories would be in the red during the current season. The total loss suffered by the industry in 1974-75 season is estimated at Rs 64 crores.

Another adverse effect of the heavy excise duty on free sugar is that it leads to the wide disparity between the price of free sugar and levy sugar. It is reported that considerable quantities of free sugar allotted to the rural areas ultimately finds its way into the open market. Such a trend is undesirable and needs to be effectively checked.

Therefore, even from the point of view of minimising such leakage, it is desirable that the excise duty on free sugar should be reduced substantially.

Even from the revenue point of view, the continuance of the high rate of excise on free sugar is hardly justified. Because, at the time the duty was increased in the last Union Budget, the sugar production was visualised at about 40 lakh to 42 lakh tonnes, but the actual output has now turned out to be of an all-time record level of 44 lakh tonnes. An appropriate reduction in duty on free sugar would not, therefore, disturb the budgetary position. Another point which deserves consideration of the Government in this behalf is the adverse effect which the continuance of the high excise duty is likely to have on production of sugar during the current season 1975-76, because, with a high excise duty on free sugar and the much lower incidence thereof on khandsari, the latter would have a comparatively more competitive capacity to divert cane from factory areas to khandsari manufacture. This would no doubt affect the sugar output, which is hardly desirable. In view of these considerations, the Union Finance Ministry should review this matter and reduce the excise duty on free sugar appropriately.

Record sugar exports

The great leap forward in production in 1974-75 season has also helped larger exports which has contributed, to a very large extent, compared to any other industry, to the alleviation of the acute problem of shortage of foreign exchange which has been aggravated by the oil crisis. Sugar, in fact, has now emerged as the largest foreign exchange earner for the country contributing over 15 per cent of the country's total foreign exchange earnings. Out of the 1974-75 season's production, the Government has released for exports 13 lakh tonnes which consist of 6 lakh tonnes levy sugar and 7 lakh tonnes free sugar, accounting for about 27 per cent of the total output during the season. As against this, during the preceding season 1973-74, the Government had released for export only 5 lakh tonnes representing about 13 per cent of the output. The total foreign exchange earnings from sugar exports out of the current season's production are estimated at Rs 580 crores including a rupee profit of Rs 230 crores to the Government. A particularly heartening development has been that the foreign exchange

earnings from sugar exports have increased not only on account of an increase in the unit value, which has been the case with most of the primary commodities, but also because of the increase in quantum.

It may be recalled here that sugar exports on a fair scale was started for the first time in 1957 when the quantity exported was about 1.5 lakh tonnes earning a foreign exchange of about Rs 11.9 crores. Since then sugar exports have continued regularly, though in varying quantities depending on its output. Between 1957 and 1974, the total foreign exchange earnings from sugar have been about Rs 509 crores including Rs 215 crores earned during 1974 alone, from an export of about 5 lakh tonnes. This will be clear from the details given in Table 2.

Table 2: Sugar exports: 1957-1974

Year	Exports in lakh tonnes	Foreign exchange earned in crores of Rs
1957 ..	1.46	11.89
1958 ..	0.50	24.07
1959 ..	0.16	0.80
1960 ..	0.18	0.80
1961 ..	2.68	13.31
1962 ..	3.73	14.76
1963 ..	4.79	33.51
1964 ..	2.34	19.07
1965 ..	2.67	11.56
1966 ..	4.41	17.60
1967 ..	2.16	14.85
1968 ..	0.99	10.44
1969 ..	0.94	9.85
1970 ..	3.18	25.70
1971 ..	3.22	31.51
1972 ..	0.99	12.52
1973 ..	2.49	42.21
1974 ..	5.06	215.00
Total ...	41.95	509.45

The actual quantity shipped during the period January to October 1975 has been 8.02 lakh tonnes. The break up of monthwise shipments during the above period is given in Table 3.

Table 3: Monthwise shipments of Sugar: January to October 1975

Shipments	Tonnes
January 1975 ..	47,991
February 1975 ..	1,00,277
March 1975 ..	87,737
April 1975 ..	69,761
May 1975 ..	66,641
June 1975 ..	43,568
July 1975 ..	69,199
August 1975 ..	1,51,531
September 1975 ..	93,049
October 1975 ..	71,860
Total	8,01,614

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As Table 3 shows the shipments have been rather erratic and of irregular pattern. This could have been avoided with better co-ordination between sales on the one hand and larger storage facilities at the ports. Table 4 gives the details of destination-wise shipments from January to October 1975.

Table 4: Destinationwise shipment of sugar: January to October 1975

Shipment of Indian sugar to foreign destinations	Quantity shipped (tonnes)
Iran	3,47,763
USA	1,50,228
Egypt	1,29,300
Sudan	65,631
Indonesia	34,649
UK	22,000
Yemen	16,550
Aden/Mukalla	12,100
Hungary	11,550
Jordan	9,083
El Qarter	1,500
Nepal	860
Maldives	400
Total	8,01,614

It may be pointed out here that till 1973, sugar was generally exported at a loss except in 1957 when due to attractive world sugar prices, we could make some profits. Exports were then handled exclusively by the Indian Sugar Mills Association. Exports during 1958 to 1973 were also at varying losses which were invariably shared by the industry. But ever since exports have become a profitable proposition, exports are being undertaken exclusively on Government account. At present, sugar exports are channelised through the State Trading Corporation and the entire rupee profits accrue only to the Government. It may also be interesting to note here that unlike most other commodities, the entire foreign exchange earned through sugar exports is in the form of untied currency free from any encumbrances to be utilised exclusively by the Government in any manner it likes.

Bank credit

Inadequate availability of bank finance also affected the industry's working during the season 1974-75. While the credit limits of the factories were pegged at the previous season's drawings disregarding the sharp increase in production and much

higher costs, the margins were also stepped up to 15 per cent on levy sugar and 25 per cent on free sugar simultaneously. In the absence of adequate bank finance, the factories faced difficulties in maintaining cane payments and meeting their other liabilities. The Reserve Bank's announcement on credit policy for the ensuing busy season says that banks have been advised to maintain a uniform margin of 15 per cent both on levy sugar and free sugar. The reduction of bank margins on free sugar which has been restored at the old rate of 15 per cent, is a step in the right direction. However, similar consideration has not been shown in respect of margin on levy sugar which also needs to be reduced to 5 per cent to ensure better liquidity of funds with the factories for prompt payment of cane price and other dues. Since the price of levy sugar, which is heavily subsidised, is statutorily determined by the Government there are no fluctuations therein and banks would not be running any risk in reducing the margin thereon to 5 per cent.

New capacity

The Union Government has fixed a capacity target of 60 lakh tonnes for the Fifth Five Year Plan for achieving a sugar output of 57 lakh tonnes. Against this, the total licensed capacity now is about 69 lakh tonnes. Besides, about 2.12 lakh tonnes additional capacity is expected to be put up, under the liberalised licensing policy for which no licence is required. But the actual installed capacity in the 1974-75 season, including new units which had a trial run, was only 44.98 lakh tonnes.

Table 5 gives the regionwise figures of installed capacity during the season 1973-74 as also the new capacity added by way of new factories and expansions during the season 1974-75.

As will be noted from table 5 there is a wide gap of nearly 24 lakh tonnes between the capacity licensed and actually installed. There was a spillover of 46 new units from the Fourth Plan to the Fifth Plan while 56 new units have been licensed during the Fifth Plan. In consideration of the difficulties of the present licensees in putting up new units, the Government has recently decided to license further capacity by way of expansions in existing units where such requests are supported by adequate

availability of cane and finance. Besides, applications for new units in the public sector where adequate financial provision existed in the State Plan would also be considered. As expansions are less costly and can be brought into effect more quickly, they should be given preference and encouraged as compared to new units. In this context, the repeated demand of the industry for the creation of a revolving fund as recommended by expert bodies for providing loans to the existing sugar factories on easy terms also needs urgent consideration of the Government.

Prospects for the new season

According to the latest information available, the overall cane acreage for 1975-76 season is more or less the same as last year, though some shrinkage therein is reported in some of the regions like Tamil Nadu, Bihar, Eastern Uttar Pradesh and Central Uttar Pradesh. This, however, is likely to

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be made up by increases reported in certain other regions. The crop condition is also reported to be generally satisfactory though late heavy rain is likely to cause a decline in recovery. Actually pre-starting cane analysis reports of some of the mills indicate a decline of 0.5 to 0.7 per cent in recovery compared to last year. Further the starting of crushing operations has been delayed this year owing to low recoveries and the absence of excise rebates to compensate for higher costs. Moreover, the Government has decided to continue the same sugar policy for the next year as well with the same statutorily fixed cane prices. In view of the above factors, it appears that sugar output during the current season 1975-76 may be somewhat lower than that achieved in the previous year.

Table 5: Installed capacity of sugar: 1973-74 to 1974-75

Zone	Installed capacity in 1973-74	Capacity installed during 1974-75				Capacity installed during 1974-75	Total caap at the end o 1974-7
		New Units		Expansion			
		No.	Capacity	No.	Capacity		
Andhra Pradesh ..	0.03	1	0.13	1	0.11	0.24	3.27
Assam	0.05	—	—	—	—	—	0.05
Bihar	3.39	—	—	—	—	—	3.39
Gujarat	2.03	1	0.19	—	—	0.19	2.22
Haryana	0.67	—	—	—	—	—	0.67
Kerala	0.22	—	—	—	—	—	0.22
Madhya Pradesh ..	0.43	—	—	—	—	—	0.43
Maharashtra	11.85	3	0.60	2	0.26	0.86	12.71
Karnataka	3.30	2	0.35	—	—	0.35	3.65
Orissa	0.22	—	—	—	—	—	0.22
Punjab	0.55	—	—	—	—	—	0.55
Pondicherry	0.19	—	—	—	—	—	0.19
Rajasthan	0.22	—	—	—	—	—	0.22
Tamil Nadu	3.52	—	—	1	0.28	0.28	3.80
Uttar Pradesh	12.92	—	—	—	—	—	12.92
West Bengal	0.15	—	—	—	—	—	0.15
Nagaland	0.12	—	—	—	—	—	0.12
Goa	0.20	—	—	—	—	—	0.20
All India	43.06	7	1.27	4	0.65	1.92	44.98

PLANTATIONS

Rapid increase in production costs

by A SPECIAL CORRESPONDENT

THE performance of the plantation industry during 1975 can be said to be by and large satisfactory. The industry has maintained its production, fulfilled its export commitments apart from meeting the domestic demand. India continues to maintain her pre-eminent position in tea in the export market. The year 1974-75 was particularly encouraging in terms of both quantity exported and value realised. In absolute terms, India exported 224.9 m. kg of tea realising Rs 224 crores in foreign exchange. In coffee, 1974-75 achieved an all-time record in exports at 49,260 tonnes valued at Rs 51.36 crores.

A notable feature of 1975 was the rise in the price of plantation crops, particularly tea and coffee. The improved market conditions noticed last year were sustained. However, the price increase has to be seen against the rapid increase in the cost of production arising from domestic inflation. The prices of essential estate supplies such as fertilisers, packing material and furnace oil doubled although of course, their availability became better in recent months. Wages have gone up by about 100 per cent during the last two years and a further increase is inevitable following the promulgation of the ordinance requiring equal pay for men and women for equal work.

This ordinance affects the plantation industry particularly. This Ordinance is intended to provide for the payment of equal remuneration to men and women workers and for the prevention of discrimination on the ground of sex, against women in the matter of employment. The plantation industry is the first employment to be so notified by the Central Government and the provision of the Ordinance have become applicable from October 15 to plantations covered by the Plantations Labour Act. No discrimination against women will be permitted in plantations with regard to recruitment for the same work or work of a similar nature. It is feared that a rigid implementation of the Ordinance without making due allowance for the seasonality of agricultural operations in plantations will lead to practical difficulties and even disrupt existing negotiated wage structure.

In the tea industry about 56 per cent workers are women; in coffee it is

46 per cent and in rubber women account for about 30 per cent. In plantations while the practice of engagement of men and women workers in the same work or work of a similar nature will vary from estate to estate, the wage structure is negotiated between the trade unions and the employers on an industry-wide basis.

Despite the joint Note of Dissent put up by the employers' and employees' representatives that Welfare Officers need not be appointed in plantations under Section 18 of the Plantations Labour Act, action has been initiated to enforce Section 18. This is evident from the publication of draft Rules by some of the State Governments. The Government of Karnataka has already published draft rules and has sought the views of employers' and workers' organisations. The Welfare Officers, according to the draft Rules, are required to supervise the implementation of the various provisions of the Plantations Labour Act. The industry's view is that there already exists a well staffed Inspectorate appointed by the Government for the purpose and the interposition of welfare officers will only lead to further complications and additional costs.

The problem now before the producers is one of trying to maintain themselves in business and keep the industry going. Notwithstanding the increase in prices, the planting community argues, that the increase was not in sympathy with the rising costs or taxation. Besides, the cumulative effect of these would not only affect the export capability of the industry in the world market but would also have its chain effect on domestic consumption.

Tea

In spite of drought conditions which prevailed in North India, the current indications are that in 1975 tea would set another record production at over 500 m. kg.

Tea production during the first ten months of 1975 was up by 1.5 m. kg at 420.2 m. kg. The shortfall in North Indian production has been made up by South India. At the end of October, South Indian output was up by 6.8 m. kg at 88.3 m. kg compared to the corresponding period last year.

The overall crop of major producing countries registered a rise of 9.3 m. kg at 730 m. kg. Sri Lanka reported a rise of 15.8 m. kg at 181.4 m. kg during this period. Kenya, in spite of early shortcomings, has improved her performance.

Exports from India during the first five months of 1975 totalled 71 m. kg valued at Rs 82 crores as against 78 m. kg valued at Rs 74 crores in the corresponding period last year. It is expected that exports will touch a record earning of Rs 230 crores.

Tea prices which were more or less stagnant for some years, have shown buoyant tendencies since early 1974. The overall position as on December 2, is given in Table 1.

Table 1: Tea prices as at December 2

	Average price of tea at different auction centres	
	1974	1975
London — pence per kg (1st Jan—28th Nov)	59.33	62.25
Calcutta — Rs per kg .. (upto 22nd Oct)	11.85	12.74
Cochin — Rs per kg .. (1st Jan—2nd Dec)	8.43	9.70
Coonoor — Rs per kg .. (1st Jan—29th Nov)	7.44	8.2

The price has to be seen against the background of the steep increase in the cost of production as stated earlier.

Recognising the importance of the contributions made by tea, a Committee was recently set up by the Tea Board, at the initiative of the Commerce Minister, to go into the short-term and long-term measures for stepping up tea exports. On the short-term aspects, the Committee is understood to have recommended the grant of draw back on excise duty on aluminium foil used in tea packing, increase in the rebate on excise duty for blended and packet teas, grant of import entitlement for packet teas and tea bags, liberalisation of the blank permit facilities from the Reserve Bank of India for promotional expenditure and internal transport subsidy (upto Bombay port) for packet teas. The Government has already announced its decision to grant draw back of the excise duty on aluminium foil and to offer a cash compensatory support at the rate of 10 per cent of the f.o.b. value for instant tea, tea bags and packet tea. The deliberations on the long-term measures are in progress.

However, the industry's plea for removal of any part of the excise duty now levied on a zonal basis in respect of the tea exported has not been

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accepted by the Government. At present the rebate of excise duty on exports is limited to 85 paise per kg and the rebate is allowed to the extent of the excise duty paid. Table 2 indicates the present zonal rates of excise duty with the rebates provided for each zone:

Table 2: Zonal rates of excise and rebates

Zones	Rate of excise duty per kg	Maximum rebate allowed on exports per kg	Remainder of excise duty applicable to exports per kg
Zone I	40 P.	40 P.	Nil
Zone II	60 P.	60 P.	Nil
Zone III	140 P.	85 P.	55 P.
Zone IV	110 P.	85 P.	25 P.
Zone V	130 P.	85 P.	45 P.

The producers' argument is that no other producer in the world pays an excise duty on exports and the industry in India is placed at a disadvantage. Besides, it applies with discrimination when the rebate is not equal to the excise duty paid. It also goes contrary to the Government's intention to encourage the export of higher priced tea.

In the last year's review, reference was made in detail in these columns to the multi-dimensional international agreement for tea. Following this, an International Tea Symposium on Tea Market Expansion was held in London in December, 1974, jointly organised by the Commonwealth Secretariat and the International Trade Centre, UNCTAD/GATT with the co-operation of the FAO, which recommended the setting up of an International Tea Promotion Council. The Working Party of the FAO met in Rome between the 2nd and 8th April, 1975, but it did not reach any conclusion in regard to the multi-dimensional programme except on tea promotion. Following this, a two-member UN-sponsored delegation visited a number of tea producing countries with a view to seeking the support of the respective Governments on the setting up of an International Tea Promotion Council. Their report is awaited.

Coffee

Aided by adverse factors affecting production in some of the major coffee

growing countries, such as frost in Brazil and the internal unrest in Angola, there had been a shortfall in the world supply of coffee which resulted in India benefiting from the increase in international prices.

The coffee crop for 1974-75 is now estimated at 92,000 tonnes. Receipts upto November 15 into the Pool was 91,689 tonnes made up of 62,165 tonnes of different grades of Arabica and 29,534 tonnes of Robusta. The 1975-76 crop is expected to be about 92,000 tonnes which is the same as the 1974-75 crop.

Exports from India during April to October 1975 totalled 38,355 tonnes valued at Rs 38.69 crores. The year is expected to end with a total export of 57,000 tonnes, i.e. 2,000 tonnes more than the record export level achieved last year.

Coffee prices in the export auctions during 1975 showed a marked increase over the prices secured in 1974. The average price secured for Plantation 'A' in the export auctions during January to October was Rs 602 per 50 kg as against Rs 450 in the corresponding period last year.

The US Department of Agriculture has put the world coffee crop and the exportable surplus during 1975-76 at 8 per cent and 12 per cent lower respectively when compared to the 1974-75 crop. The world coffee crop for 1975-76 has been estimated at 72.4 million bags and the exportable crop at 52.7 million bags.

The new World Coffee Agreement is expected to come into force in October 1976 and will be in operation for six years. Although the results of the deliberations at the recent ICO conference are yet to be formally announced, it is understood that export quotas would be fixed on average export performance of the years 1968 to 1972 or actual average performance of the first two years of the new agreement namely 1976-77 and 1977-78.

As was to be expected, the sharp rise in export prices was due to adverse factors in major producing countries. It must, however, be recognised that since world prices are necessarily dictated by the supply and demand considerations, there is nothing to guarantee that the present trend will continue. Therefore, it would be in the best interest of both the producers and the Government to encourage and develop the domestic market. At present the domestic consumption of coffee has stagnated at

around 39,000 tonnes per annum. learnt that this question is under consideration by a Market Evaluation Committee of the Coffee Board whose report is awaited.

Rubber

Admittedly, the increasing demand in recent years for rubber goods, particularly tyres, has given a fillip to development of rubber plantations. With the recession in the tyre industry due to the hike in oil prices and large stocks of unsold tyres, the present situation is one of very low offtake of rubber by manufacturers. As a result the natural rubber market has crashed much to the detriment of over 1,20,000 growers.

Prices which were ruling at more than Rs 900 per quintal early this year have declined to Rs 730 per quintal. Offtake of rubber by manufacturers during January-September 1975 was 97,064 tonnes—a fall of 3,314 tonnes from the corresponding period last year. This has resulted in the accumulation of stocks.

Despite prolonged monsoon, production of natural rubber during the first nine months of 1975 was up 9,871 tonnes at 92,309 tonnes. Synthetic rubber production has also registered an increase of 3,414 tonnes at 15,784 tonnes compared to the same period last year. The revised estimate of natural rubber production during 1975-76 has now been estimated at 1,42,000 tonnes and that of synthetic rubber at 23,000 tonnes.

The declining trend in prices has caused the reduced offtake by manufacturers causing concern to the rubber growers. The rubber prices were fixed by the Tariff Commission in 1970. While it may be expected that once the offtake by manufacturers increases, the prices may also increase. But it is not known whether the increase in costs that has taken place since 1970 would give the producer the margin that was intended by the 1970 costing.

Cardamom

The exchange earnings from cardamom marked an all-time record of Rs 13.32 crores against the target of Rs 11.50 crores during 1974-75. The unit export value realised during April-June 1975 was Rs 95.33 per kg as against Rs 70 per kg during the same period of the previous year. The 1974-75 (September-August) production is estimated to be in the region of 2,700 tonnes.

STOCK MARKETS—I

Investment climate: No time for optimism or pessimism

A. FARUQUI

THE stock market reflects economic pressures. It causes neither booms nor recessions, inflation or deflation. Its rises, high or low, are results; not causes. In a stock market governed by rigidly-enforced rules designed to prevent manipulations, share transactions simply reveal the hopes, fears and convictions of all investors. As a practical matter, a well-balanced investment policy should give equal weight to the realities of the present and the long-term projections of the future. At the moment, the realities of the present do not suggest any great degree of bullishness, partly because the flow of money into the stock market is still moderate.

The uses of money are competitive, meaning that money flows into consumption or into savings or into business investments or into stocks in response to changing factors of attraction. Ever since the promulgation of the ordinance restricting dividend distribution and the consequent slump in stock prices, there has been a large-scale diversion of investible funds to industrial units in the form of fixed deposits. The interest rates offered on company deposits are quite attractive, ranging from 12 to 15 per cent depending on the period of deposit. Many business houses are still making a big thrust for deposits because the commercial banks' lending rates have gone up so high that direct deposits from public have become a cheaper form of borrowing. The funds will possibly not come back into the stock market unless and until the money picture changes in the direction of lower rates and the dividend restriction is completely withdrawn.

To find the real status of the present economic situation one must recognise that business activity can be measured by knowing how people feel about it psychologically, and evaluating evidence. Discouraged by the recessionary tendencies of the moment and by pressure on profit margins, businessmen are keeping close control on their budgets. Caution is apparent in scheduling new outlays for plant and equipment. Even though there are always projects which could be

undertaken if money were there, profit levels are neither providing the means nor justifying borrowings or stock issues. As a matter of fact many companies have been penalised by growth because the cost of building new plant and other facilities with which to meet this growth has exerted real pressure on the rate of return and diluted the gain in per share earnings by the issue of fresh share capital. With the operating rate down to the 50-60 per cent range in a number of industries, an early end to the profit squeeze is not now foreseen.

Most of the cotton textile units have reported substantially lower profits for 1974-75. The growing consumer resistance and non-lifting of goods by the dealers due to scarcity of funds led to a huge accumulation of stocks which had to be disposed of at lower prices. The recessionary trends in the overseas markets also worsened the situation. It may be pointed out that cloth prices were nearly doubled during the 1973-74 boom period. Unless and until the prices are slashed further, there is no likelihood of any significant revival in the consumer demand. Profitable price relationships do not necessarily imply higher prices. Lower prices produce demand and increased demand means more production with consequently lower costs per unit.

The capital goods industries have also been hit hard by the recessionary trends; many are working below 50 per cent capacity. The automobile industry is in deep trouble. The production and sale of passenger cars and jeeps have dropped sharply. Even the demand for commercial vehicles has slackened. This, in turn, has affected the offtake of automobile tyres. According to recent press reports, stocks of automobile tyres with the industry reached an all-time high of about Rs 60 crores in November last. There has also been a steep fall in the demand for refrigeration equipment, air-conditioners and TV sets. Aluminium units are also reported to be burdened with a heavy accumulation of stocks. The present outlook for shipping companies is quite depressing due to a sharp decline in freight rates. Divi-

dend cuts are expected to be fairly widespread because of a substantial drop in earnings. A new price formula for drugs and formulations is likely to be announced shortly. Profits of the pharmaceutical units will therefore, depend mainly on the contents of the new price policy.

Many businesses are still under pressure to bring inventories into better balance with orders and sales. Businessmen raised the amount of inventories they felt they needed in relation to sales as a hedge against shortages and still higher future costs. There is considerable historical evidence to suggest that desired inventory-sales (I/S) ratios fluctuate sharply over all business cycles. Desired I/S ratios typically rise during cyclical up-swings as businessmen anticipate that sales will continue to increase. And conversely, desired I/S ratios slide downward when managers foresee declining sales.

There is little doubt, with final demand slipping and financing costs still high, that inventory investment will be cut back sharply. The biggest question is whether businessmen will over-react to the inflated inventory demand of 1973-74 and cut inventories even more drastically than would be expected as a result of the economic slowdown. The manner in which the inventory over-hung is adjusted will clearly affect the course of recovery from the current recession. A low but positive rate of inventory investment would probably help to moderate the severity of the downturn. But it would also keep actual stocks at rather high levels—that is, high in relation to what is desired. And in that case, the stimulus that normally comes from a rapidly increasing inventory demand in the early stages of recovery would be weakened.

There now seems to be a greater degree of appreciation in official circles about the need for stimulating the growth of the economy. The Government is reported to have asked the FICCI to draw up a blueprint for the entire industrial sector to maximise capacity utilisation and step up exports. The industrial licensing policy has been liberalised by exempting from licensing 21 industries in the medium sector and permitting unlimited expansion of foreign companies and monopoly houses in 30 other important industries like cement, paper, basic drugs, chemicals and heavy industrial and electrical equipment provided the excess production is either exported or

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sold in accordance with the directions of the Government. Some relaxation in credit curbs have been announced for the 1975-76 busy season. While the interests rate structure has been kept unchanged, the additional margins on bank advances against book debts and inventories imposed in November 1973, as a part of the anti-inflationary measures, have been withdrawn.

More recently, the Government announced a package of measures to stimulate the economy through increased public expenditure. The measures include stepping up of construction activity with a view to increasing the demand for cement, steel and other construction materials, and augmentation of urban transport system to give a fillip to the commercial vehicle industry. To restore the confidence of the investing public, the Government also acted to put a floor under the falling stock market by reducing the time lag between two successive bonus issues from 40 months to 24 months. The relaxation has given a psychological boost to the stock market which has remained crippled for a long time. The Government has, however, ruled out any relaxation in the present monetary discipline or any adjustments in the excise duties in the current financial year. We will perhaps have to wait till the next budget for some meaningful fiscal reliefs. For the present, it seems unwise to figure on a rush into equities.

Industry and business circles are inclined to be too critical of the monetary authorities. It may well be that the reluctance of the Reserve Bank to take any aggressive step in the direction of easy money stems from the reasoning that lower corporate profit margins and lower stock market prices are secondary considerations to the more important question of how much money the people as a whole are getting and spending. On the record, the Reserve Bank does not like to anticipate trends; it prefers to wait until the statistical evidence is solidly established before deciding upon an important change in policy.

The outlook for business has improved with the emergence of a number of favourable factors viz., record farm output, easier availability of basic industrial raw materials, reasonable price stability, peaceful industrial relations, improved transport facilities and

increase in power supply. Yet it is doubtful that changes in general business will be sufficiently great for individual industries or companies to get very excited about or to suggest that a new persistent upward trend has been established in the economy. People who are looking for a sharp upturn in 1976, however, are likely to be disappointed when they continue to find keen competition on all sides, new capacity still coming into production, increasingly choosy buyers, and presumably declining capital expenditures.

STOCK MARKETS—2

Bombay: Investors cautious and selective

By OUR OWN CORRESPONDENT

THE stock exchange, almost since the days it came to be conceived, had been looked upon, as indeed it is being looked upon even today, as the barometer of the country's economy. Every single factor—economic, political and psychological—went into determining the quotations of the day. The stock exchange reflected as much the hope and confidence of a people in their country's future as it did their anguish and disappointment if things were going wrong.

In Samvat 2031, the stock exchange appeared to be shedding its time-honoured role, in part if not in entirety. Although the market used to react promptly to events and factors and the quotations at various periods of the year by and large reflected the ups and downs of the economy, life rather seemed to be lacking. The speculative fraternity which made or marred the market found the soil not so conducive this time while the investing public, the real backbone of the stock exchange, remained cautious and selective, if not apathetic. Therefore, price movements during the year, barring of course on occasions, tended to be erratic with business confined for most part of the year to jobbers and professional operators. One often wondered whether the stock exchange, as an institution, was not getting outmoded. With speculators slowly but reluctantly receding to the background, the stock exchange will survive more as an investment market rather than as a battlefield of bulls and bears.

In short, this is no time for optimism or pessimism but for down-to-earth realism. Now is the time for individual industries and companies to demonstrate their capability. Indian buying potential is enormous. The key to profitable growth in the future may be in a much better understanding of research, consumers, production, personnel and costs. We should not forget that money always stays relatively tight for people who have not proved their ability to control costs and use money wisely. Perhaps all this sounds fairly obvious.

Returning to details, equities, at the year began, were ruling steady with the All-India Index for Value of Dividend Securities, in other words equity index, having improved from 100.00 in November (Base year 1970) to 103.1 in December to 103.8 in January. Sentiment was aided primarily by the hope of some relaxation in respect of dividends and secondly by reports of a likely enlargement of the scope for the private sector amendments to the MRTP Act. Prime Minister's repudiation of the emergence of the recessionary trend emboldened bull operators to build long positions which they promptly

At this point the market was coming rather vulnerable. Although price levels and the index along with it were far below the previous year's top, the recovery during November and December of the year which however was in the nature of a technical correction and that in January of the year under review warranted a reaction which did occur in the following month when the All-India Index declined sharply to 102.4. The Bombay Stock Exchange Index, in the meantime, declined from its January level of 102.8 to 102.8 in February. Apart from technical considerations, the reaction was also explained as having been caused by scepticism about the outlook for the economy and the market was not enough to take in these sceptical views. Another contributory factor, though of a passing nature, was the fluctuation caused by reports of default by a stock operator in Scindia.

Thereafter the market moved out indecisively both days tending more to ease than recover in view of the usual pre-Budget uncertainty and a precautionary liquidation. The absence of any increase in passenger fares in the Railway Budget with only a nominal increase in freights raised fresh hopes and the natural expectation was for a relaxation in dividend restrictions. Bears began hastily to cover their positions while bulls lent fresh support albeit on a selective basis. Amateur speculators followed the professionals like sheep taking the market up to its year's high in the pre-Budget session of the stock exchange.

The Finance Minister, however, chose not to oblige. He made practically no concession in respect of dividends on which bulls had staked their last penny. The provision for deferred payments of any dividend in excess of 12 per cent spread over a period of two years, meant to be a concession, failed to enthuse. The other concessions that were so eagerly being looked forward to failed to come while such of those concessions as were given did not mean much to the habitual visitors at the stock exchange. Result: bulls began to throw away their positions as quickly as they had built them and there was virtually no support.

Thereafter it was a case of the market gradually drifting down to lower levels week after week. The All-India Index for March was 101.8 and the Bombay Regional Index declined from its February level of 102.8 to 101.5 in the following month. The All-India Index for April, May and June averaged to 96.6, 94.8 and 91.7 respectively, the June average being the lowest for the year.

Then came the Emergency to which the market reacted readily and favourably. Industry was particularly happy that there was an end to being plagued by labour agitations and the disruption of output if not its entire stoppage. There was an end too to the sort of anarchic situation which was fast developing in the country. Industry also welcomed the Prime Minister's 21-point programme which in its opinion would help build the kind of democratic environment most conducive to economic progress. This feeling on the part of industry was amply reflected by the All-India Index which registered a sharp spurt from 90.4 for the week ended June 28 to 97.2 for the week ended July 26.

One expected the market to cross its previous high and advance further but this did not materialise. The mar-

ket however did not decline, for bear operators, having burnt their fingers, preferred to be cautious. The market moved about in a sort of trading and the range was invariably narrow. The All-India Index for the week ended August 9 was 99.4 but the post-Emergency highest was 99.6 touched in the beginning of September. Thereafter the market tended to drift gradually downwards. The Index for the week ended October 25 was 94.00.

The main factor behind the lethargic conditions of the recent weeks was the restriction on dividends. With good companies offering anything between 13 per cent and 16 per cent on deposits few investors would care to go in for equity investment. Risk capital ought to fetch a higher return than deposits. Investors would be even more indifferent to new capital particularly in view of the long gestation periods. It was precisely for this reason that the response to new issues was far behind the expectations of the promoters. Most of the issues were reported to be oversubscribed but invariably the underwriters had to take upon themselves a sizable slice. Some issues owed their success to the personality and influence of the promoters but by and large issues "south of the Godavari," as a prominent broker-underwriter put it, were left high and dry.

This probably was one of the main reasons for the reportedly poor showing of Vikrant Tyres of Mysore although there were some other factors such as the immensity of the issue, arrival in the market at the wrong time and reported sales by such of those as had

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been made firm offers. Even in respect of Apollo Tyres, subscription in real terms was said to be small but Godfrey Phillips was about four times oversubscribed. J. K. got through with institutional support just the same way. Tinsplate (another huge issue) got through but Maharashtra Electrosmelts failed to evoke much of a response from the investing public.

This indicates that investors are looking forward to more by way of incentives. At any rate they are waiting for the market to look up, or more precisely for bullish conditions to come into being. At the moment it is difficult to say what the market is going to be like but the situation is such as to make a bull market more of a possibility than a bear one. The Supreme Court verdict in favour of the Prime Minister has led to the justifiable belief that the economic growth of the country would now be speedier than ever before. Furthermore, the dividend curbs would after all end with July. The policy of the Government in respect of the private sector is also likely to be pragmatic and the private sector may be given a role greater than now.

One should therefore expect the market gradually to improve and establish a decisive trend by Budget time. The Budget is hoped to be practical and helpful. The recent relaxation in the terms and conditions of bonus share issues could be taken as an indication.

STOCK MARKETS—3

Calcutta: Sentiment improves towards year-end

From OUR OWN CORRESPONDENT

FOR the investing public 1975 turned out to be somewhat disappointing for the major part of the year due to a host of factors that impeded growth of India's economy. The year began on a dull note for the share markets, Lyons Range being no exception, as both investors and professionals preferred to keep away due partly to the spill-over influence of the dividend restrictions imposed by the Government in July 1974 coupled with the restraints on the issue of bonus shares.

The main point worrying the stock market community has been the absence of steps by New Delhi to correct the distortions in interest rates which have tended to induce flow of funds away from equities. The outlook for equities had been seriously impaired by the dividend curbs on the one hand and the high interest rate structure on the other. While the scope for capital appreciation even when the corporate sector is doing well has been undermined by the restriction on payment of dividends,

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investible funds moved out in search of other more profitable avenues.

Apart from this, an uneasy feeling developed over the further cut in power supplies by the Tamil Nadu and Maharashtra Governments threatening to affect industrial production. The prolonged jute industry strike also induced caution. Activity in the market consequently shrank appreciably and prices tended to lose ground steadily. Budget uncertainties added to the caution and dealings were confined to limited counters. Even the tax concession granted to investors in Unit Trust of India's units failed to evoke any interest. The Government had, through an ordinance, amended the UTI Act providing for grant of further relief from income-tax to the extent of Rs 2,000 for income from units over and above the existing limit of Rs 3,000 already available in respect of certain approved investments. There was also a provision for exemption up to Rs 25,000 from wealth tax on investments in units over and above the limit already available.

It was about this time that recessionary trends were in evidence in many of the industries. The Union Ministers, Mr C. Subramaniam and Mr T. A. Pai, had repeatedly emphasised that fears of a recession overtaking the Indian economy were baseless. But all this failed to make any impression on the market which continued to drift in listless trading. Pre-Budget rumours emerging later brought some semblance of steadiness on optimistic hopes that the Finance Minister would remove the dividend restrictions and take realistic steps to stimulate the capital market.

But the mood of optimism that dominated the trading sentiment for over a fortnight evaporated rather too soon giving way to a feeling of despair when the Union budget was presented by Mr Subramaniam. Share prices beat a sharp retreat on nervous bull unloading, renewed bear hammering and lack of fresh support. All the gains accumulated during the period of a fortnight prior to the Budget were wiped out in just two sessions. The deterioration in sentiment reflected the utter disappointment of the market with the Budget. It was not that the Budget was completely bearish but it had read too much into the Central Finance Minister's declared concern about the depressed state of the capital market and Mr Subramaniam's statement that the Budget

would be saving, investment and production-oriented.

The fond hopes of the market were belied. Expectations of a relief in personal taxation, particularly in respect of the upward revision of the exemption limit to promote savings, did not materialise. Disappointment came because of the withdrawal of the tax exemption given in respect of dividends paid by companies out of tax holiday profits. The market also felt that the hike in excise duties on a number of commodities would tend to push up costs and erode corporate profits because of the growing consumer resistance noticed in many areas.

Although the Finance Minister did make some changes in respect of the Dividend Restriction Act, it fell far short of market expectations. The proposed amendment to the Dividend Act permitting companies to declare dividends in excess of the ceiling, the excess dividend being treated as deferred dividend payable in two annual instalments but without interest after the expiry of the present Act, was dubbed as an eye-wash as it brought no immediate relief to the investor. The adverse reaction to the Budget persisted for some time and share prices sought fresh low levels in the absence of support. Industrial circles held the view that the corporate sector had not been treated sympathetically, and that nothing had been done to encourage better utilisation of capacity to bring about an increase in production was widely felt. Judging from the dividends declared by companies after the presentation of the Budget it is clear that they thought very poorly of the proposed relaxation in the dividend legislation. The various concessions granted in the Budget designed to promote savings and give a direction to the flow of investible resources to the priority sectors were considered to be too inadequate to have any significant impact.

For instance, Dunlop India, which opened the week in which the Budget was presented at Rs 29.50, declined to Rs 29.20. Orient Paper was depressed at Rs 48.00 against the opening of Rs 49.70. Losses varying in extent were recorded in other scrips as well. The drooping trend in prices persisted in the market for about a month before a mild rally emerged towards the close of March on technical considerations. Liberalisation of credit limits against inventories for the jute industry, the World Bank's favourable assessment of Indian economy and its recommendations for a \$1,500 million aid for 1975-76, optimistic forecasts of the rabi crop and the marked decline in the rate of in-

flation also aided sentiment. Although the dividend amendment bill failed to cheer the market, favourable factors that aided sentiment included the extension of the cash subsidy for 39 engineering export items under the re-scheme from April 1, relaxation of supply of furnace oil and the abolition of export duty on jute carpet bag cloth with a view to improving competitive position *vis-a-vis* synthetic substitutes in the world markets, especially in the USA.

But the rally appeared to be short-lived and prices suffered a set-back less than a week's time and the downward trend extended in the wake of light but persistent selling. This reversal at one stage brought apprehensions in the minds of many that it might be long before the equity price index struck a new low for the year. With inflationary pressures beginning to assert themselves and the whole price index on the rise again, there seemed no chance of any relaxation of credit and monetary discipline. And if the interest rates remained at the existing levels, investors were unlikely to put their savings in equities which offered very poor yield. Other uncertainties disturbing the market were devaluation of its Taka by Bangladesh which would create serious difficulties to Indian jute goods with its inevitable impact on the future of the jute industry, power shortage posing a big problem in quite a few States and the not too easy situation faced by the textile industry.

Business shrank appreciably about this time and dull conditions prevailed in the market, although corporate news was generally good. Even ministerial assurances about additional measures to revive the capital market did not have any effect on the market. The cause of worry of operators was that both the Prime Minister and the Finance Minister had stressed the need for strict monetary discipline to keep inflationary pressures under check. This state of stalemate in business continued for a period with operators generally awaiting steps to revive the capital market. As a result, prices continued to drift

Concerned at the hopeless state of the capital market, the Presidents of the stock exchanges in the country met the Finance Minister, Mr C. Subramaniam, on May 29 with a number of suggestions for reviving the capital market. These included the raising of a ceiling on distribution of dividends, liberalisation in the tax deducted at source on dividends, relaxation of restrictions on advances against share

vestment of provident funds and other monies in shares, shortening the lag between two bonus share issues, guaranteed return on investment in equity shares in the initial years of operation and the resumption of forward trading.

The market sentiment suddenly deteriorated following the publication of the Allahabad High Court's verdict seating the Prime Minister, Mrs Indira Gandhi, and debarring her from contesting the elections for six years. Equity prices tumbled over a wide front as a nervous bull liquidation touched off by the news, because of its possible impact on political stability in the country. The depressed state of the market played despite encouraging corporate news including higher dividends announced by a few companies. The relaxation of power curbs announced by the Tamil Nadu and Maharashtra Governments and the prospect of adequate assistance from the Aid-India Consortium did not bring any cheer to the market at this stage.

The end of the half-year saw a recovery in share prices in the wake of the series of sweeping ordinances, including those against smugglers and black money holders, promulgated by the Government. At this stage institutional support that was forthcoming further aided the recovery effort providing for a return of confidence in the market. The Prime Minister's assurance that the Government did not have any plans for nationalisation of industries or impose new controls on them was also welcomed by the market which derived comfort from her comprehensive 20-point economic programme designed to bring quick relief to vulnerable sections of the rural population, urban middle class and imparting new dynamism to the economy. The decision to raise the income-tax limit from Rs 6,000 to Rs 8,000 was widely welcomed. The volume of business expanded with activity broadening in line with the rise in prices. Technical considerations alone favoured a rally as the preceding steep fall in prices had brought the market within less than 2 per cent of its last year's bottom in October. The favourable pointers for improvement of the economy included Government's determination, as disclosed in repeated official statements, to accelerate the pace of industrial and economic growth and the assurance of full co-operation in stepping up production in industry by both leaders of industry and labour. Marketmen felt confident that the steps against smugglers, tax evaders and black-marketeers and the ceiling on

urban property would help considerably in diverting the flow of investible funds to the share markets. More so because the dividend legislation was due to expire in July 1976.

The improvement in prices was by no means confined to the popular speculative scrips. Gains were widespread and non-cleared securities also participated in the upward thrust of the market, bulls again coming into their own. This rally in fact lifted shares to such an extent that more than half of the ground lost since the presentation of the Central Budget was recovered. The impression gained ground in market circles that the psychology of emergency was being fully exploited to bring down prices of essential commodities and tackle effectively tax evasion, besides boosting agricultural and industrial production.

Trading sentiment improved further in the wake of the announcement relaxing some of the restrictions imposed on the issue of bonus shares. The series of measures taken by the Government to inject fresh blood into the stagnating economy, such as removing many of the procedural delays in the way of rapid expansion of essential industries, were helpful in boosting sentiment further. The market also noted the satisfactory progress of the south-west monsoon raising hopes of a normal kharif crop. All these favourable influences served to give a fresh push to share prices which by the end of July had reached within striking distance of the highest levels of the year. The market appeared to be greatly impressed by the Finance Minister, Mr C. Subramaniam's assessment of the economic prospect presented to Parliament on July 30. The review stated that the Indian economy was poised for a major phase of rapid expansion. The national income was expected to go up by 6 per cent this year against 2 per cent last year. Industrial production was also expected to record a growth rate of about 6 per cent following the marked improvement in the supply of power and coal and transport facilities.

At this time the market appeared in such a bullish mood that it virtually ignored anything discouraging. It owed much of its strength to sustained institutional support with both Unit Trust and the General Insurance Corporation figuring as important buyers. But the trend gave way to a reactionary phase shortly thereafter following the developments in the neighbouring Bangladesh where sudden political unrest emerged in August with the assassina-

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tion of Sheikh Mujibur Rahman. The reaction, however, was considered healthy as it improved the technical position of the market at this stage. Although the general tenor of corporate news was quite encouraging, it failed to cheer the market because of reports of recessionary trends experienced by a large number of industries. Several industries in which the share markets have a good stake have been facing an accumulation of goods due to the continuing slackness in demand and their margins have come under stepped up pressure. A dull phase prevailed in the market for some time and even favourable developments like clear indications that the kharif harvest would be a record one and that the overall industrial production growth would be of the order of 6 per cent to 7 per cent failed to have any impact on the market.

About the middle of November a fresh spurt of buoyancy in the market was seen as buyers returned to lend fair support to equities. They were encouraged, among other things, by New Delhi's new package of measures to boost the capital market and to stimulate demand in certain vital sectors. The market hailed the new package interpreting it as a clear indication of the Government's anxiety to relax more and more the restraints affecting the economy. By recognising that there is need for positive steps to give a push to industries like building construction, transport and jute, which have been passing through serious stagnation in activity, the Government has admitted

Price movements of important shares on the Calcutta stock exchange during 1975

Name of Scrip	Opening	High-est	Low-est	Closing
Ballarpur Paper	38.50	51.90	24.90	28.20
Brooke Bond ..	29.50	37.80	27.40	31.00
CAFI	23.80	27.30	19.00	25.50
Dunlop	28.62	35.25	27.90	33.60
GKW	26.10	29.90	22.55	26.60
Gwalior Rayon	32.85	43.50	32.40	43.20
Hind Motor ..	6.90	8.25	4.50	5.80
Ind. Aluminium	17.35	22.30	14.80	22.30
Indian Explosives	19.45	26.50	17.50	25.80
India Steamship	28.60	34.70	13.35	16.90
Indian Oxygen	17.60	19.00	14.00	17.60
Kesoram Induss.	26.30	30.98	22.25	29.00
Orient Paper ..	44.10	52.00	44.00	50.90
Orissa Cement..	23.00	26.25	21.15	25.60
Philips India ..	50.25	57.55	23.00	25.95
Straw Products..	18.15	21.40	17.10	18.70
Union Carbide ..	37.75	42.30	23.25	27.10

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that the problems of these industries are not imaginary or self-created. The announcement of a 10 per cent cash compensation on exports of carpet backing cloth and specialities was welcomed.

The sentiment of the market improved further when the Prime Minister, in a speech, defended the mixed economy. The Supreme Court's verdict

in the Prime Minister's case setting aside the Allahabad High Court's judgment, brought comfort to the market. The spectacular recovery in shares in the course of a few sessions indicated the mood of marketmen who not only lent support to popular scrips but also the second and third rank shares. The approach of the year-end seemed encouraging. Equities have begun a come-back and, with so many encouraging influences already on the horizon, there is optimism that share prices would look up further in the new year, if New Delhi continued its helpful policies.

stimulate production and demand. measures so far announced are inadequate; nevertheless, they are proof that the government is alive to the situation and anxious to correct it.

A cell has also been set up to suggest ways and means of activating capital markets. The conditions for issue of bonus shares have been eased. The time-lag between two successive issues has been reduced from months to 24 months. Further, applications for bonus shares can hereafter be made after 12 months from listing of the earlier bonus shares on the Stock Exchange or completion of despatch of scrips, instead of 36 months heretofore. While stock markets have responded favourably to these developments, they can regain their normal health if further reliefs are afforded in the forthcoming budget, and the dividend restrictions removed. The dear money policy, distinct from the credit squeeze, should also be reoriented. Preferential treatment in interest rates should be granted to new and existing industries. Only then will there be a free flow of funds to equity investments and sustained recovery in share prices.

The Reserve Bank of India equity index (base 1970-71=100) which stood at 105.4 at the start of the year dropped to 90.4 for the week ended June 1975 which was the lowest so far this year. After recovering to 99.8 in early September, 1975, it fell back to 90.4 during the first week of November 1975. Since then there has been some improvement. Even so the year 1975 recorded an average overall loss of about 11 per cent in equity values.

The Madras market commenced the year on an easy note. The increase in the power-cut in Tamil Nadu from 40 to 60 per cent was a bearish factor. The decline in the course of the first five weeks of the year averaged a sharp fall over 9 per cent. The statement of the finance minister at the pre-budget meeting of the Parliamentary Consultative Committee of his ministry that the budget would be production and investment oriented brought about a welcome transformation in the sentiment. The lost ground was not only recovered, but fresh gains were recorded right up to the end of February. The budget proposals, however, were not up to expectations. The bonus issue guidelines were not relaxed. The anticipated respite from fresh levies could not also materialise. It was feared that the fresh indirect imposts which amounted to as much as Rs 288 crore would erode savings further. The doubts about the relaxation of the de-

STOCK MARKETS—4

Madras: Despondency throughout the year

From OUR OWN CORRESPONDENT

STOCK markets were despondent almost throughout the year mainly due to the devastation wrought by the dividend limitation in an era of escalated interest rates. Investors in industrial securities suffered grievous losses both in the value of their investments and current return. The unprecedented hike in the Bank Rate to 9 per cent and the consequent increase in interest rates obliged the government to revise the standard rate of interest on debentures to 10-10½ per cent and dividend on preference shares to 11 per cent. The continuance of the dear money policy had aroused expectations of a higher return on risk capital. But the government refused to recognise the logical implications of its dear money policy with regard to dividends, and the amendments to the Temporary Restriction on Dividends Act were conceived in a half-hearted manner. Without effectively removing the severity of the restrictions and after an inordinate delay, the statutory limitation on the declaration of dividends has been withdrawn, and companies have been allowed to declare dividends in excess of the distributable profit as defined in the Act. But the payment thereof has been restricted to the stipulated ceiling, the excess dividend being payable in two equal annual instalments, after the expiry of the Act, with interest at 8 per cent per annum. The invidious ceiling of one-third of the net profit has neither been removed, nor the preference dividend excluded from the quantum that could be distributed as dividend. The impetuous relaxation has not satisfied the need of the equity investors and

has not, therefore, helped the professed aim of reviving investors' confidence. The denial of current income, at least commensurate with the return available elsewhere, has resulted in the deterioration of the morale of the investors. With the pitifully low return available on equities, investible funds were diverted to other lucrative fields, and the stock markets were in the doldrums.

The economic slow-down has also been responsible for the lack of support to equities even at levels which are well below their intrinsic merits. It is a paradox that while, as a result of inflation, the current value of industrial assets has multiplied manifold, reflecting a higher break-up value for the shares which are but component parts, the market prices for the very same shares are unduly depressed and in many cases stand at a discount. This strange situation has arisen because of the contradictions in official policies. The prohibitive incidence of excise duties has induced consumer resistance. Industries are now confronted with the demand recession resulting in a cut-back in production and idle capacity. While the raw material position has improved, the slackening demand, credit constraints and increase in fuel costs will cumulatively eat into profit-margins. It is, therefore, apprehended that the profit levels of the previous year could not be maintained, and this is yet another deterrent to the revival of confidence in equity investments. A silver lining to the cloud is that the government has initiated a series of steps to

and curb were not spelt out. Hence disposition was to lighten commitments, and share values slid down throughout the month of March.

In April, the unprecedented total shut-down of power for industries in Tamil Nadu was yet another powerful impetus which accelerated the declining trend. There was a technical recovery during mid-May. The amendments to the dividend restriction fell short of expectations and caused considerable disappointment. So the market resumed its downward journey, and the lowest for the year was touched during the last week of June.

The twenty-point programme for economic revival announced by the Prime Minister soon after the proclamation of the national Emergency had tonic effect. The timely advent of the south-west monsoon improved crop prospects as well as the power outlook. Tamil Nadu lifted the power-cut. A remarkable recovery was recorded in July, and the firm trend persisted, albeit punctuated by profit-taking, till the end of August. The reversal of the upward swing which started in September continued till the announcement, in the second week of November, of the package of measures designed to stimulate off-take of steel, cement, cotton textiles, etc. The guidelines for the issue of bonus shares were also relaxed. Share values registered handsome gains, but the best levels could not be held due to profit-taking. Nevertheless, the closing tone was steady.

Government securities

Activity was confined to the captive investors like provident funds, gratuities and other institutions. Prices firmed up as the year progressed. The Reserve Bank of India conducted the usual open market operations. The Central government borrowed in July Rs 440 crores gross by the issue of three loans, viz., 5½ per cent 1982 at Rs 99.40 per cent, 6 per cent 1993 at Rs 98.50 per cent and 6½ per cent 2003 at par. After taking into account the repayment of 4½ per cent 1975 loan the net amount raised was Rs 233 crores. The second phase will be completed on December 1, 1975 by the issue of 6½ per cent 1996 loan at par. The notified amount is Rs 200 crores and with the right to retain ten per cent in excess, the total amount may come to about Rs 220 crores. The aggregate borrowing by the Centre for 1975-76 will be of the order of Rs 660 crores gross or Rs 453 crores net against the budget estimate of Rs 532 crores gross or Rs 325 crores net. The State governments borrowed a total of Rs 273.22 crores by the issue of 6 per cent 1985 loans at 99 per cent.

Madras : Price fluctuations in pivotal shares in 1975

(In rupees)

Shares	Paid up per share Rs	Opening (2-1-75) Rs	Highest Rs	Lowest Rs	Closing (28-11-75) Rs	Dividend %	
						1974	1975
Banks							
Andhra	100	91.00	97.00	86.00	97.00	10	—
Electrics							
South Madras	10	16.00	15.20	12.50	12.90	12	Nil
Vellore	10	26.75	26.75	16.25	16.25	Nil	Nil
Sugars							
Aruna	10	11.35	11.55	6.25	6.40	14	—
Deccan	5	7.00	7.00	3.65	3.65	12	Nil
E.I.D.	20Sh.	12.10	21.10	12.90	14.35	8	—
Kothari	10	8.80	8.80	5.15	5.15	9	Nil
Sakthi	10	10.75	10.90	5.80	6.30	12	Nil
Rubber							
Cochin Malabar	3	6.35	7.05	6.15	6.75	11	12
Kailas	2	4.50	4.50	2.63	2.90	10	12
Malankara	10	26.80	26.80	21.75	22.50	12	30
Pullangode	2	3.25	3.85	3.06	3.65	12	20
Rajagiri	10	15.65	15.65	10.00	12.00	9	9
Thirumbadi	1	1.60	2.40	1.53	2.35	12	—
Rubber and Tea							
Midland	10	11.50	11.50	7.80	8.00	10	10
T.R. & Tea	10	7.10	7.25	6.55	6.80	10	—
Tea							
Highland	10	12.30	12.50	9.90	10.40	12	—
Kalasa	2	2.57	3.60	2.57	3.50	12	12
Nelliampathy	2	2.75	3.50	2.80	3.00	12	12
Nonsuch	10	15.00	15.00	9.75	10.50	12	—
Parkside	10	17.50	22.00	17.50	22.00	12	26
Peermade	10	9.75	9.75	8.00	8.00	10	—
Periakaramalai	2	2.55	3.35	2.50	3.15	9	10
United Nilgiri	10	17.50	17.50	12.75	15.00	10	18
Tea and Coffee							
Chembra Peak	2	2.55	3.20	2.55	2.57	12	12
Kil Kotagiri	2	1.85	2.32	1.62	2.13	2½	7
Neelamalai	5	3.75	4.00	3.10	3.30	Nil	Nil
Manjushree	2	2.40	3.45	2.40	3.08	6½	12
Coffee							
Coffee Lands	10	15.25	19.25	15.25	15.50	5½	12
Consolidated Coffee	10	18.70	20.50	15.15	18.75	12	20
Textiles							
Anglo-French	100	202.00	235.00	175.00	214.00	8.9	—
Lakshmi	50	78.00	78.00	65.00	65.25	12	9
Madura Coats	10	—	10.50	7.55	7.90	—	8.4
Mettur Beardsell	100	198.00	213.00	175.00	175.90	12	25
South India Viscose	100	313.00	345.00	276.00	342.00	12	—
Travancore Rayon	10	15.35	15.35	9.25	10.35	16	—
Cements							
Dalmia	10	9.30	10.70	8.10	10.45	8	—
India	5	3.05	3.70	2.25	2.85	Nil	Nil
Madras	100	89.00	89.00	49.50	61.00	Nil	—
Chemicals and Fertilisers							
Chemicals and Plastics	100	131.00	132.00	105.00	105.00	Nil	Nil
F.A.C.Ts.	10	3.70	4.35	2.60	4.25	Nil	Nil
Mettur Chemicals	10	7.70	8.70	6.20	8.30	Nil	4
S.P.I.C.	10	16.25	17.75	11.25	12.75	Nil	Nil
Trav. Chem. Mfg.	10	21.00	22.50	14.00	14.00	12	14
Paper							
Mysore	10	21.00	21.00	14.75	14.75	10	8 i
Seshasayee	10	14.00	14.00	11.00	12.75	12	12
Transport							
Ashok Leyland	5	8.40	8.40	7.20	8.30	12	—
South India Shipping	100	146.00	230.00	132.00	165.00	17	40
Tube Investments	100	113.00	122.00	108.00	108.00	10	—
Miscellaneous							
Aluminium Industries	10	4.10	7.00	3.60	6.75	Nil	Nil
Binny	100	65.00	69.50	41.00	43.50	Nil	Nil
Engine Valves	10	14.50	15.25	13.12	13.25	9.5	12
Kothari (Madras)	10	9.35	11.25	7.85	11.25	12	15
Lakshmi Machine Works	100	155.00	162.00	126.50	138.00	10	—
Madras Aluminium	100	88.00	121.00	61.00	94.00	Nil	—
Madras Rubber	10	34.00	40.00	16.50	17.00	12	—
McDowell	10	12.37	12.37	8.25	8.25	7½	—
Parrys Confectionery	1	1.25	1.25	0.62	0.65	Nil	—
Rallis	100	190.00	197.00	176.00	185.00	12	—
Rane (Madras)	5	7.50	7.80	5.90	7.20	9.5	12
Spencer	10	24.00	24.75	23.75	24.75	11	12
Textools	100	52.00	52.00	39.00	49.00	Nil	Nil
United Breweries	10	23.62	23.62	8.50	8.50	12	7½

i=Interim

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Of the Southern States, Tamil Nadu raised Rs 26.30 crores, Andhra Rs 24.09 crores, Karnataka Rs 18.01 crores and Kerala Rs 9.13 crores.

Sugar

As the year progressed, sugar shares lost their sweetness. Many companies skipped the dividends. Even with a record production of about 49 lakh tonnes, sugar units were obliged to report disappointing results due to the unremunerative price of levy sugar, lower average on free sale and the fall in the recovery rate due to drought conditions. The production in 1975-76 is placed at about 45 lakh tonnes. The current year's prospects for sugar industries are far from encouraging. Due to the diversion of acreage, cane supply is expected to be inadequate. International prices have also declined. Sugar shares, therefore, met with selling pressure and fell steeply. The government has just announced incentives for the industry in the form of variations in free sale quota and excise duty reliefs to new units and those undertaking expansion.

Rubber

The performance of rubber scrips was mixed. Dividends were stepped up. Despite a rise in consumption, there is a glut of raw rubber in the market. The current year's output is estimated to be about 1.45 lakh tonnes. The government has agreed in principle to export about 5,000 tonnes. International prices are lower than the indigenous prices.

Tea

Select tea shares met with enlarged activity. With a few exceptions, closing prices showed moderate gains. Dividends were either maintained or stepped up. The South Indian output during January-August, 1975 was higher by 7 million kg, at 67.6 million kg. Tea prices rule better. In London, South Indian tea prices improved by 12 per cent and at Cochin auctions by about 19 per cent.

Coffee

This section also attracted better attention. Popular companies declared higher dividends. Production for 1974-75 was 91,539 tonnes, which was the largest since 1970-71. For 1975-76 the estimate is placed at about 90,000 tonnes. Export prices which showed a declining trend have picked up again. Owing to the frost damage in Brazil, reported to be to the extent of 70 to 80 per cent and the loss in crop caused by disrup-

tion in estates in Angola, our export auction prices have risen sharply from the lowest reached between January and April this year, the increase being of the order of 50 to 75 per cent depending on grades and quality. The effect of the frost damage will be felt for at least two or three years, during which period prices are expected to be remunerative to growers. Prospects for coffee shares can, therefore, be reckoned as bright.

Textiles

The textile industry has been badly hit by the crisis of a precipitous fall in demand, and stocks of cotton, yarn and fabrics have been mounting up. So textile shares were neglected and closed lower. Rayon scrips were mixed. The Reserve Bank has relaxed temporarily credit curbs for cotton spinning mills. The government has recently introduced some measures to clear the glut.

Cement

The severe power-cut affected production programmes in the first half of the year, while in the second half the industry had to face a fall in off-take. Cement shares, after remaining depressed, gained some ground, but the closing levels were lower than the opening rates in many cases. Recently the government has allowed differential retention prices for producers.

Paper

Working results for 1974-75 disclosed handsome improvement in pro-

fits, despite stagnation in production. Paper shares were moderately active. The current year's outlook is reported to be not very encouraging in view of the slackening demand.

Miscellaneous

Chemical shares put up a mixed performance. Engineering industries were affected by the recessionary trend. Automobile ancillaries as well as units were in turn affected by a sharp fall in demand for passenger cars. Shares belonging to these industries therefore, closed lower. Aluminium shares managed to close the year with net gains. Dual pricing was extended to aluminium producers, but the distribution control was not removed. A steep increase in excise duties and a hike in power tariff jacked up costs and induced a recession in off-take. The decision to reintroduce prohibition in a phased manner pushed down prices of brewery shares. The performance of the miscellaneous section conformed to the general trend.

Fixed interest securities

In view of the dear money policy and high interest rates, prices of preference shares and debentures were easier and activity extremely restricted.

The table on page 367 gives the price-range of representative shares during the year and the dividends far declared with comparative disbursements for last year.

COMMODITIES MARKETS—I

Cotton: Search for buyers

By S. LAXMINARAIN

THE 1974-75 cotton year, with an estimated overall supply of around 88 lakh bales, ought to have presented no problems to the mill industry, the Government or the growers. And yet, the season saw almost all those vitally concerned with cotton in difficulties. In the face of a record crop, we had the paradoxical decision of the Government offering special concessions to facilitate the import of two lakh bales of Pakistani cotton at a cost of Rs 25 crores. The protests raised by the farm lobby, against aggravating the supply position with its inevitable impact on prices, were brushed aside. Apparently, it was a political decision. It is significant to note that at the time the Indo-Pak agreement was signed,

about 45 mills in Pakistan had totally or partially closed down due to a slump in yarn and textile prices.

When the growers in India were groaning under the weight of unlifted stocks, the Government's decision on cotton imports from Pakistan naturally led to widespread consternation. The Union Commerce Minister was obliged to make a statement that the Government did not propose to import more cotton "than was absolutely essential." This was followed by the authorities asking the Cotton Corporation of India to go to the rescue of the cotton cultivators by extending its price-supporting operations. The Minister justified Pak cotton imports on the plea that there was a shortage

short and medium-staple cotton. In addition, he argued that Karachi cotton would indeed help India meet the requirements of textile export production.

The shortfall in short and medium cotton was more than compensated for by an unprecedented spurt in the production of long-staple cotton. This was the result of a deliberate policy by the Central and State Government authorities since 1971-72 aimed at the elimination of imports. During the season under report, Hybrid 4 and MCU were two of the more popular LS cottons, which accounted for 12 lakh bales. When the growers found it more remunerative to concentrate on the propagation of LS cotton, there was an inevitable let-back in the production of other varieties of cotton.

The mill industry had its own version of the demand position of cotton. At the Cotton Advisory Board meeting on January 20, industry spokesmen called for the import of at least five lakh bales, all from Pakistan, if possible, as the calculations were that mill consumption would be around 68 lakh bales and the domestic output would not be quite sufficient. The growers, on the other hand, pointed out that the co-operative societies were practically bursting at the seams with unsold stocks and prices were most unattractive thanks to the continuance of the RBI credit curbs.

What precisely were the chances of the Cotton Corporation coming to the aid of the growers? Addressing a farmers' gathering in Coimbatore on January 19, Mr G. Ramanujam, CCI Chairman, said that the working funds allotted to the Corporation amounted to just Rs 10 crores against Rs 900 crores worth of cotton annually transacted in the country. If the CCI could not enter the cotton market in a big way, it could have no decisive influence on the prices.

Soon, however, following the assurance from the Union Finance Minister that more funds would be made available to the Corporation, it was decided that bulk purchases should be made of long-staple cotton of which prices had been ruling pretty low. It was ironic that better quality cotton, on the production of which more money had been spent by the farmers, should go abegging thus. When the CCI entered the market, promising to make part payment in cash and part by way of bonds redeemable over a period, the initial enthusiasm of the farmers gave place to disappointment. A public sector agency did not have the where-

withal for doing a job for which it had been created. Paradoxically, CCI's purchase operations, it was explained, were aimed at bringing about (i) greater equity in returns from different varieties of cotton, and (ii) the evolution of a rational cotton production pattern both in terms of quantity and acreage under cultivation in different growths.

That the CCI could do little to assuage the anxiety of the farmers became clear when attempts began to be made to find export markets for LS cotton. By the middle of March, it was estimated that at least eight lakh bales of long-staple cotton could be exported, fetching the country foreign exchange worth Rs 100 crores. With four lakh bales carried over from 1973-74 and an estimated output of 17 lakh bales in 1974-75, the total supplies of LS cotton were placed at 21 lakh bales of which the industry's needs were put at 11 lakh bales. When the issue, in response to the growers' plea for export, was taken up at the Executive Committee of the Congress Parliamentary Party on March 25, Mrs Gandhi indicated that she would support the move to export cotton.

The move to find export outlets for India's LS cotton was apparently born out of desperation. The Government had obviously its own reservations on the subject. Otherwise, it is hard to explain why only one lakh bales were sanctioned to be exported in the first instance in the face of an estimated exportable surplus of nearly 10 lakh bales.

The cotton authorities in India would be well advised, in the circumstances, to chalk out a long-term perspective plan so that the growers would be doubly assured that their efforts to cultivate finer varieties of cotton would be fully recompensed. The current attempt to limit LS cotton exports, when there is more to spare, should not be repeated. Once a market is found overseas for these growths, a sustained promotional campaign should be launched to ensure the export of a fixed quantum of LS cotton every year, which alone would confer lasting benefits on the Indian farmers. If such a step were taken, they need not be unduly dependent on the domestic market.

The mill industry stoutly opposed the move to export LS cotton right from the beginning. When the country was obliged to import Pakistan cotton to bridge the gap between supply and demand, where was the sense in trying to export cotton, it asked. Characterising the move as a "hasty step,"

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the industry pointed out that export of cotton would adversely affect the already low export of textiles. It was the industry's contention that the poor offtake and the low prices were not so much due to a surfeit of cotton as the incapacity of most mills to effect purchases for want of funds.

It took four months, after the initial decision to export, for the Government to decide on the need to abolish the export duty on LS cotton. This was a delayed step which was compounded by a wrong step in entrusting the work to the Cotton Corporation of India which had little experience of the export market. The only exportable cotton for which India had gained international reputation, Bengal Deshi, had been, and is still being, handled by the private trade. The Farmers' Parliamentary Forum questioned the wisdom of canalising exports through the CCI and pointed out that the Corporation's past record had been "neither clean nor helpful" to the growers. The Forum suggested that export should be allowed to any party for any destination and urged the Government for a 20 per cent subsidy to ensure any meaningful thrust on the export front.

The Indian Cotton Mills' Federation, confronted with the firm commitment of the Government to export cotton, suggested that a better course would be to build up a buffer stock. On account of the world-wide recession in textiles, the Federation declared, there was practically no scope for cotton exports as most countries in the West had already resorted to a cut in their cloth and yarn production. Besides, the prevailing market prices of Indian LS cotton were above those in world markets, providing little attraction for the foreign buyer. The Federation also said that it was fallacious to argue that the Indian mill industry had not the capacity to consume all the LS cotton grown in the country. If adequate credit was made available to the mills, the situation, according to the Federation, would improve to a considerable extent in favour of the cotton farmer.

The Federation also argued that another remedy for facilitating the improvement in the mills' offtake of finer cotton would be to correct the lopsided nature of the excise duty which was heavily weighted against the production of fine and superfine

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counts. "To continue the present system is to inflict a penalty on our cotton growers for all the trouble they took for growing better varieties of cotton and saving the country precious foreign exchange," the ICMF pointed out. In the light of these arguments, the Federation held the view that a prudent course would be to stockpile the surplus cotton to even out fluctuations in supply in subsequent seasons.

By the time the season came to a close, hardly 6,000 bales had been actually shipped out of India. There were difficulties, too, in the domestic marketing of cotton. At a time when there is a threat of a glut in domestic supplies, the role of the procurement agency, in protecting the interests of the farmers, gains special significance. Unfortunately, the procurement operations of the Maharashtra State Co-operative Marketing Federation were hanging fire practically throughout the season. The reason was that there were no funds to manage its affairs despite the known political goodwill the monopoly procurement scheme enjoyed at the hands of the State as well as the Centre.

The Estimate Committee of the Maharashtra Legislature recorded that "the Government's handling of the scheme so far has not been satisfactory." This was said in the second week of December when three months had passed after the end of the 1974-75 season. The panel said that it was "unfortunate" that even last year's dues to the tune of Rs 92 crores had still remained outstanding with no programme to clear them off by a definite date. Again, the Committee was constrained to make the unpalatable point that the public accountability of the existing monopoly scheme was not "satisfactory." The panel suggested that the State Government should find its own resources to finance the scheme without relying on the Centre or the Reserve Bank of India.

It was on January 6, 1975 that the Minister of State for Irrigation and Agriculture announced that the Maharashtra Government would not suspend or withdraw this year's monopoly purchase scheme. When he made the statement, the season was already four months old and the progress of procurement was far from satisfactory. In the third week of January, the State Minister for Co-operation was obliged to tell the farmers that it was impos-

sible to accede to their demand for allowing private trade in the procurement scheme.

On February 10, the scheme was suspended. The reason, as given by Mr Y. J. Mohite, Minister for Co-operation was the "overflow of the storage capacity at the procurement centres." Meanwhile, there had been sporadic stirs by the growers demanding option to sell their cotton to neighbouring States at higher prices. The Executive Committee of the Maharashtra State Cotton Growers' Association threatened to stage a mass fast if the scheme was not favourably changed.

The new Chief Minister, Mr S. B. Chavan, said in a broadcast on February 21 that he would try and see that the scheme was put on a more sound and solid basis. Mr Mohite announced early in March that the Reserve Bank had released only Rs 20 crores against the credit requirements of Rs 125 crores.

Speaking at the 16th annual general meeting of the Maharashtra State Co-operative Marketing Federation on May 28, the Chief Minister called upon the Federation to be self-reliant by commercial operations instead of depending on Government aid. He exhorted the Federation to win the confidence of the farmers by clean administration and prompt service. By the second week of June, the scheme had come to such a pass that the Chief Minister was constrained to admit that procurement was in distress due to paucity of funds. He added that the Centre had considered the scheme "inflationary."

Even by August, the last month of the season, attempts were being made to woo the Centre to release a ways and means advance of Rs 60 crores. Mr Mohite, meanwhile, confessed that there was considerable distress among the State's farmers about the delay in clearing their dues, amounting to Rs 143.12 crores, against cotton purchases made in 1974-75. By the time the Centre announced its decision to give Rs 16 crores as interim advance, the season was practically over. The MSCMF found itself holding a stock of 12.50 lakh bales, valued at over Rs 180 crores, out of a total procurement of 17.60 lakh bales. Faced with such a desperate situation, the Federation offered the bait of cotton on credit to the mills, a basic requirement in cotton deals in which the merchants are adept.

The overall supply position of cotton for 1975-76, is such as to throw a challenge in marketing for both public sector agencies. Although initially the crop was expected to be around 75 lakh bales, this estimate was trimmed to 70 lakh bales following a prolonged break in rains and late precipitation in some parts of Maharashtra, Gujarat and Madhya Pradesh. However, the Cotton Advisory Board which met on December 6 put the crop at 65 lakh to 66 lakh bales (180 kg), the basis of which the cotton balance sheet that emerges is shown in Table 1.

Table 1 : Cotton balance sheet
(in lakh bales (180 kg.)

	Indian	Foreign	Total
Carry-over stocks on August 30, 1974 ..	24.34	2.15	26.49
Estimated crop for 1975-76	66.00	—	66.00
Imports	—	2.00	2.00
Total supplies ..	90.34	4.15	94.49
Mill consumption ..	66.00	3.00	69.00
Ambar charkha and surgical dressings ..	1.50	—	1.50
Exports	4.50	—	4.50
Total disappearance ..	72.00	3.00	75.00
Carry-over on August 30, 1975 ..	18.34	1.15	19.49

It will be seen from the foregoing that there is an erosion of the opening stock position to the extent of 7 lakh bales. Taking this into consideration the Board categorically expressed its view that no further commitment should be made to release additional quantity for cotton export. Representatives of the Maharashtra Government had pressed for the release of additional export quota to enable the State to dispose of its old stocks.

Unless steps are taken to provide for adequate funds, both for the Cotton Corporation of India and the Maharashtra State Co-operative Marketing Federation, streamlining of cotton marketing to the ultimate benefit of growers would not be possible. It is to be hoped that both these agencies have learnt their lessons from the very bitter experience that they had in marketing cotton throughout the 1974-75 season.

COMMODITY MARKETS—2

Jute industry: A year of crises

from OUR OWN CORRESPONDENT

CALCUTTA.

THE outgoing 1975 will go down in the history of the jute industry as one of the worst years on account of a number of factors which brought financial crisis leading to closure of some of the weaker units.

On the one hand, jute mills were obliged to keep up the optimum level of their output to avoid lay-offs and on the other they had to hold on to large accumulated stocks of manufactured goods because of a sharp contraction in world demand coupled with shrinkage in domestic business. While 505,900 tonnes during January-July this year, the output has been nominal or higher, exports have been 81,400 tonnes less at 247,200 tonnes compared to the same period last year. As a result, there has been an average monthly accretion of 15,000 tonnes to the inventory with all its impact on the price position as well as resulting in a widening of the margin of loss.

The very survival of the industry came under threat because of mounting losses due to a widening cost-price gap. For instance, in the first 10 months of this year, the industry lost roughly Rs 44.51 crores with little indication at that time that prices will improve in the near future. October-end stocks were a staggering 1,39,000 tonnes including 55,000 tonnes of hessian. Sacking stocks which had been of a manageable volume might also rise sharply holding dismal prospects for the future months. Thus, the depressed outlook for jute goods prices stems from the bearish implications of the industry's statistical position.

Demand pattern

The two months before the year began were reasonably satisfactory, and the industry could fetch profits on its working. But, as the new year opened, the industry found itself faced with a series of crises starting from the prolonged 48-day strike by jute workers. Incidentally, this was the longest ever work stoppage in the jute mill industry during its long history, and curiously enough it occurred exactly about the same time as the one which lasted for 33 days in the previous year. The situation took a turn for the worse when the all-India port and dock workers also staged a wild-cat strike for four days about this time. For a week or

so, therefore, around mid-January, everything on the jute front came to a standstill causing deep concern to the industry. Fortunately, however, the port strike ended without much of delay, but the strike by jute workers continued for a longer spell. With the mills' order books not being that encouraging as compared to the corresponding period of 1974, neither the Central government nor the State government appeared to be willing to force the industry then to concede the demands of the workers raised in their 14-point charter of demands, which included enhancement of DA and bonus. The end of the strike saw a net production loss of Rs 102 crores to the industry.

Concerned at the persisting recession in demand for jute goods in the world markets coupled with the severe price competition offered by synthetic products and Bangladesh jute industry, the Indian Jute Mills' Association urged the Central and State governments that there should be a production regulation in line with the demand pattern. But the request was rejected by the government on the ground that any cut-back in production will lead to greater problems arising from industrial unrest. Around August or so, the State Trading Corporation of India put forth a suggestion for a cash subsidy of Rs 200 per tonne for carpet backing, if the industry agreed to canalise its exports through the STC. But the scheme was ultimately given up on technical grounds.

The problems of the industry, meanwhile, continued, and leaders of the industry made repeated appeals for urgent action by the government to pull it out of the morass. According to them, the first essential step to relieve the industry of its financial crisis is the reduction of margin on bank credit to a flat 10 per cent from the prevailing level of 35 per cent. Otherwise, even if their cash credit limits are enhanced, jute mills would be unable to take advantage of the higher accommodation in view of their inability to provide the margin money. They estimated the credit requirements of the industry at Rs 205 crores a year, the corresponding requirement of margin being about Rs 78 crores. They urged that any rescue operation in the industry's plight has to concentrate on correcting the supply-demand im-

balance on the one hand, and making good the industry's loss in meeting competition from synthetics on the other. A realistic assistance scheme is urgently called for also to enable the industry to purchase raw jute on a scale sufficient to maintain the prices at a satisfactory level.

As a first step to help the industry the Union government abolished the export duty of Rs 600 a tonne on hessian early in June. It had earlier withdrawn the export duty of Rs 200 a tonne levied on carpet backing. These measures followed the recommendations of a high-powered industry-government jute delegation led by the Union Commerce Secretary, Mr S. G. Bose Mullick, which made an on-the-spot study of the demand position for jute goods in the USA and Canada. The export duty of Rs 150 a tonne on sacking was, however, retained. About this time, however, Bangladesh, which was till then underquoting India to the extent of 10 per cent, devalued its currency, Taka, by 58 per cent. This step more than offset the advantages gained by the Indian industry as a result of the export duty relief. Thus, the price edge the Bangladesh products had continued to remain.

In October, the Union Commerce Ministry announced yet another relief to the industry. It granted a cash compensatory support of 10 per cent of the f.o.b. value on export of jute carpet backing and jute specialities, namely decorative fabrics and products thereof. The scheme is to remain in force for a period of six months beginning from October 1, 1975. With this step, the industry can be said to have scored one of the several points it had been raising with the government for quite some time past to improve the health of the industry.

Statutory minimum

Official circles felt that these measures would go a long way in helping the jute mills manufacturing carpet backing and other specialities. They believed that the profit which the industry would make by exporting carpet backing would help offset the losses suffered in other constructions like hessian and sacking. In actual terms, an export of carpet backing will get a cash assistance of Rs 520 in the export of one tonne of carpet backing at the minimum registration price of Rs 5,200 a tonne. So, on the basis of a monthly average export of 14,000 tonnes of carpet backing from India, the total subsidy for a six-month period to the mills may come to Rs 4.37 crores. If there are increased exports

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of this construction, the loss of this order to the exchequer could be easily offset. But there is a serious doubt in the minds of leaders of the industry regarding such prospects. They feel that the cash subsidy itself cannot cure the ills of the industry which is today faced with so many problems. The outlook for the industry will continue to remain "gloomy" unless steps are urgently taken to correct the imbalance of supply and demand, they argued. The industry, meanwhile, is understood to be working on a plan currently to shift a portion of heavy sacking capacity of mills to the production of lightweight hessian because it feels that such a change will help conserve raw-jute in a year of shortage, besides maintaining a reasonable ratio in lines of production. The plan is subject to Government's approval.

Yet another cause for anxiety to the industry is the shortfall in raw-jute production for the second consecutive year. This year's production is estimated to be 5.5 million bales. But ironically the price of raw jute at growers' level fell below the statutory minimum of Rs 135 per quintal fixed by the government, although it remained at Rs 66 a maund basis assam bottoms delivered at Calcutta generally. Attempts of the Jute Corporation of India and the State co-operatives to maintain the price level through price support operations did not have much effect, causing concern to the growers and also in regard to the sowings for the next crop. The JCI absorbed about 5.65 lakh bales in 1974-75 from that year's crop of 5.8 million

bales. Mills also took less jute at 46.49 lakh bales compared to 68.69 lakh bales in the previous season.

In the current season, however, the JCI, which had been allotted a fund of Rs 24 crores for price support operations, bought a total of 2 lakh bales up to the end of October. There is growing apprehension that the JCI's purchases might not exceed last year's level, because the major part of the crop has already moved into the hands of strong intermediaries from the growers. The Jute Commissioner took quick steps to protect the interests of growers, following reports that the fibre price had fallen below the statutory minimum in some districts. He issued directives to the jute mills under jute licensing and control order prescribing weekly purchase quotas and stock limits to be maintained by them. Jute mills which had failed to comply with his directive have been told that they would face penal action, and 16 mills have been listed for such step.

Four members

Statistics with the Indian Jute Mills Association and the Jute Commissioner reveal that the availability of raw jute this year will be about 8 million bales, including the current year's crop of 5.5 million bales, a carry-over stock of 2.4 million bales and 100,000 bales imported from Bangladesh. If the industry has to maintain its current level of production, it will consume over 7.4 million bales. The village consumption will take away over 400,000 bales. Thus, the position of jute supply in the first two months of the next season will be rather difficult. Negotiations are currently under way between the JCI and the Bangladesh authorities to import the necessary quantities to

bridge the gap between supply and demand.

Industry sources are happy that further progress has been made in regard to the proposals for the formation of the Jute International. Representatives of the main jute-growing countries—India, Bangladesh and Nepal—who met recently in New Delhi to consider the draft constitution of the International, have decided to convene another conference shortly in Kathmandu to finalise and adopt the statute. The International will have its headquarters in India and the technical centre in Bangladesh. This multilateral organisation will be managed by a board of directors consisting of five members each from Bangladesh and India and one member from Nepal. One seat each will be offered to the United Nations Development Programme, the theoretician of the proposed International and the World Bank. There is hope that Thailand will join this body later on.

The aim of the International is to safeguard and promote the interests of jute-growing countries and to secure a fair price for jute in the world markets. There is no denying that synthetic manufacturers, with a modern and sophisticated scientific base at their disposal, have threatened the very existence of the natural fibre-based traditional jute industry. The synthetic producers, who own giant petro-chemical complexes, have an easy access to vast resources of petro-dollars flowing from the oil-rich countries. They are making a determined bid to dislodge jute from every area of usage by spending enormous funds on R & D efforts and market promotions.

If the International—the next meeting for its finalisation was due to

Table 1 : Production of jute goods in 1974-75 (in '000 tonnes)

	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct
Hessian	35.6	36.1	6.6	7.2	35.5	34.3	31.4	26.9	27.7	25.7	23.3	19.2
Sacking	40.9	41.9	12.2	10.9	44.8	43.5	48.3	49.2	53.9	52.7	54.1	49.0
Other constructions	18.6	16.3	3.5	3.2	13.0	10.5	10.8	13.5	19.0	19.8	21.7	20.0
Total	95.1	94.3	21.0	22.6	93.3	88.3	90.5	89.6	100.6	98.2	99.1	88.2

Stocks of jute goods in 1975 (all in thousand tonnes)

	41.7	47.0	41.1	41.6	43.6	46.0	45.3	43.0	49.9	56.1	62.4	55.1
Hessian	41.7	47.0	41.1	41.6	43.6	46.0	45.3	43.0	49.9	56.1	62.4	55.1
B.cwills (sacking)	36.8	35.5	30.6	29.8	31.3	34.1	30.1	26.0	34.5	50.5	46.0	55.8
Other constructions	27.8	32.5	31.1	31.5	33.9	33.4	31.1	29.2	28.9	28.5	27.0	27.7
Total	106.3	115.0	102.8	102.9	108.8	113.5	106.5	98.2	113.3	135.1	135.4	138.6

NOTE : The sharp drop in production during January/February reflects the long strike in jute mills during the periods.

d at Kathmandu in December 1975 starts functioning without much of a delay, it will give the much-needed blood transfusion to the jute industry through research etc. The year, therefore, ends up with a ray of hope on the jute front, because the emergence of the International will also lead to the ending of needless price competition among the main jute-producing countries, especially India and Bangladesh.

The behaviour of the gunny market in Calcutta during the year under review was in tune with the fortunes of the industry. Although in the pre-budget period the market ruled steady expectation of fiscal concessions to jute goods in the budget, the position reversed when the details of the budget came into the market. Mr C. Subramaniam, the Union Finance Minister, in his budget, gave disappointment to the jute industry and trade, while the West Bengal Finance Minister, Mr Shankar Ghosh's State budget also fell short of market expectations as he preferred to retain the multipoint tax of 1 per cent on domestic sales of jute goods. Although there were no fresh levies on end-products, the retention of residual fiscal burdens, particularly on hessian and carpet backing, in the face of falling overseas demand, caused misgivings.

After the partial cut in the export duty on carpet backing in December 1974, there remained a burden of Rs 200 a tonne on this construction, while the export duties of Rs 600 a tonne and Rs 150 a tonne on hessian and sacking respectively continued. This apart, all jute manufactures were subject to a deterrent excise duty of Rs 600 a tonne. Simultaneously, news from New Delhi indicated that the Centre was proposing to revise upwards the minimum price of rawjute. It was fixed at Rs 135 a quintal against Rs 125 previously.

About this time the jute industry found itself faced with a problem on the shipping front, and shipments of jute goods from Calcutta port have been seriously affected, following a dispute between the Indian Jute Mills' Association and the Calcutta River Transport Association over certain outstanding issues. This led to a snap decision to suspend the supply of lighters to jute mills to move jute goods to the port by the CRTA. Prices of jute goods came immediately under pressure due to the hold-up at the port, and an easier trend began to assert itself on the market dragging down both hessian and sacking constructions.

Temporary spurts

The earlier major event of jute mills strike had imparted a firm trend to the market. Even as the workers' unions served the strike notices to their respective mills, prices of ready and near delivery B-twill bags and hessian cloth started moving up steadily. The price of B-twill ready firmed up from Rs 327 per 100 bags in November 1974 to Rs 421 by the end of February, while that of hessian improved from Rs 132 per 100 yards to Rs 136. The relatively slow upward movement of hessian prices merely indicated the sluggish trend in offtake of this item by the major overseas buyers like the USA and Russia. Besides, a major proportion of the carpet backing capacity of the mills had to be earlier diverted to the production of hessian with the result that supply of this fabric exceeded demand considerably. There was hope in the industry and trade that the post-strike period would see an extension of the upward trend in prices of jute goods, but this was belied due to a persisting recession in demand caused partly by the economic recession in the USA and cheap offers made by Bangladesh.

Prices, in fact, tumbled as the gunny market started its perilous downward course in the post-budget week. They went down below the cost of manufacturing by March in the case of hessian and by July in respect of sacking. Hessian could not come back to the breakeven point for quite some time, although sacking experienced temporary spurts on reports of the IJMA's contracts with the D-GS & D some time in May for a bulk supply of 80,000 tonnes of B-twills and fertiliser bags at a negotiated price of Rs 355 per 100 bags on a delivery schedule extending up to September. This gave a shot in the arm of the construction which by then was accumulating at an average rate of 15,000 tonnes every month due to slackening demand.

The markets displayed a steadier trend following the announcement of the abolition of the export duty on carpet backing and hessian cloth. But this trend proved abortive. The reason was that, although the measure helped carpet backing to some extent, its impact on hessian was far from encouraging because Bangladesh products as well as synthetics were selling cheaper in the world markets keeping out the Indian hessian.

Concerned with the continuing sluggishness in demand for Indian jute goods and following representations from the industry, New Delhi at last announced its decision to allow a 10

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per cent cash subsidy on the f.o.b. value of jute carpet backing cloth and specialities. The industry and trade welcomed the measure as a "helpful" one but regretted that similar assistance had not been extended to hessian which was in bad shape due to a recession in the US demand.

Apprehension

The Bangladesh developments beginning from the middle of August which saw major political changes in that country brought concern to the market. Initially, it was thought that in the context of political disturbances and possible dislocation supplies of jute goods from that country would be affected and that this would lead to an increase in demand for Indian products. But, according to informed sources, the output of jute mills in Bangladesh was 38,000 tonnes in July, 39,000 tonnes in August and 40,000 tonnes in September, but their unsold stocks rose from 45,700 tonnes to 48,000 tonnes. This is reflected in the gradual decline in export registrations which were 42,500 tonnes in July, 33,600 tonnes in August and 26,500 tonnes in September. In fact, the political developments in that country has produced little impact on the jute industry in Bangladesh. Although shipments are delayed at times, production has been according to schedule so far. Even at the time of writing reports have come that Bangladesh mills are continuing to undercut Indian jute goods by 12 per cent in sacking and 2 per cent to 3 per cent in hessian.

Yet another development helping the gunny market has been the agreement at the Indo-EEC joint commission to extend the duty-free entry of Indian jute and jute goods into the markets of the UK and Denmark till June 1976. But with main buyers continuing to sit back, hessian continued to languish. In view of the decline in demand, there is apprehension that India's export earnings from jute goods in 1975-76 might drop, by over Rs 50 crores, to Rs 240 crores from about Rs 295 crores in 1974-75. Export figures show that it may not be possible for the country to make up the gap of over 100,000 tonnes in exports during April-September this year in the next six months ending March 1976.

Purchase quotas

Table 2 on price movements in the market during the year reveals that in the case of all the constructions, the

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closing prices are lower than the opening rate. In the case of heavy constructions the highest touched this year has been above that of the previous year but hessians fell back indicating that the demand trend has affected them most.

Thus, the year under review winds up with a note of uncertainty in regard to future outlook for jute goods, particularly for hessian constructions as is disclosed by the limping price trend. It is this declining trend of prices that has affected the industry's profitability, in addition to the slackening demand.

The raw jute market displayed a better trend than in the previous year, although there had been reports during September-October that the price of the fibre dipped to levels below the statutory minimum fixed by the Government in some district markets. Curiously, this has occurred despite the fact that the current year's crop has been short for the second year in succession. The year's crop is estimated at 5.5 million bales. The State agencies of the Jute Corporation of India and State co-operatives have entered the market in time with price support operations; they could mop up only about the same quantity as they did in the previous year with the result that their efforts at maintaining the price at higher levels had hardly succeeded, leaving apprehensions about the prospects of sowings for the next year.

Guaranteed return

This turn in the situation led to the drastic step of issuing compulsory weekly purchase quotas to jute mills by the Jute Commissioner under the jute licensing control order. He also made it obligatory on the part of mills to maintain weekly stocks and consumption statements to be submitted to his office. Following this, the sagging trend of prices in upcountry markets was arrested. The purchase quota was fixed at 10 weeks' consumption requirements of each mill, with a proviso that contravening mills will be facing penal action. Apart from the Government's worry to maintain the raw jute prices to protect the interest of the grower, there is anxiety in the industry circles over the jute supply position. The total supplies this year have been estimated at around 8 million bales, including this year's crop of 5.5 million bales, the carry-over from the previous year's crop

Table 2: Price movements of jute goods during 1975

(all in rupees per 100 bags for sack)

	Previous	Opening	Highest	Lowest	Closing
Hessian 40 x 7½ oz	(105.00)	105.00	108.00	78.00	79.00
Hessian 40 x 10 oz	(138.00)	133.50	141.00	102.00	107.00
Btwills	(373.00)	372.00	416.00	321.00	328.00
Heavycees	(374.00)	372.00	418.00	319.00	322.00
A-Twills (US)	(456.00)	458.00	520.00	395.00	396.00
Liverpool Twills	428.00	432.00	475.00	365.00	367.00

* N. B. Hessian is in Rupees per 100 yards

Table 3 : Price movements of raw jute during 1975

(all in rupees per maund)

Grade	Previous	Opening	Highest	Lowest	Closing
Selected Assam Agartala	(69.00)	66.00	69.00	61.00	67.40
Northern	(66.00)	62.00	66.00	58.00	64.60
West Bengal Deshi	(62.50)	65.00	73.00	61.00	68.50
Agartala Tossa	(72.00)	68.00	74.00	63.00	70.40
Assam Mesta	(63.00)	59.00	64.00	54.00	61.00
Selected Murshidabad	(60.00)	64.50	72.50	60.00	68.00

of 2.4 million bales and 100,000 bales imported from Bangladesh. At the rate of current mill production the industry will consume over 7.4 million bales and village consumption is estimated at 400,000 bales. It is thus clear that the initial months of next jute year will be full of stress and strain for the industry in respect of raw material supplies because of the poor carry-over.

Table 3 on price fluctuations during year indicates that the growers had and large, benefited more this year than in the previous years, although there is need for further steps to ensure guaranteed return to them to ensure fair crop. Perhaps the proposed Jute International, which will lay emphasis on R&D, will be a correct answer to the problem of lower jute output.

COMMODITY MARKETS—3

Oilseeds: A bear market

From OUR OWN CORRESPONDENT

BOMBAY.

PRICES of oilseeds and oils drifted all through the year in what could be described as a confirmed bear market. The trend was induced mainly by groundnuts once it became clear that the country was going to harvest a bumper crop in the 1975-76 season variously estimated at between 60 lakh and 65 lakh tonnes against just around 50 lakh tonnes in the previous season.

Groundnuts

The market in groundnuts remained firm until April during which the price of groundnut oil touched its year's peak level of Rs 8,500 per tonne. This however was not much of a price when one recalls to oneself the market, as much to the dismay of the consumer as of the Government, rose roughly to Rs 11,500 per tonne a few years ago. All the same the level of Rs 8,500 had created considerable anxiety although

the rise was owing to the poor harvest of 1974-75, a small carry-forward stock and the obvious difficulty in respect of arranging for imports.

At this level the market was about 4 per cent higher than the rate of Rs 8,125 per tonne registered at the beginning of the year. The pre-monsoon showers, by being timely and adequate enough, induced rightly enough hopes of a good harvest. The bears promptly withdrew from the market and traders were reluctant to carry stocks larger than necessitated by demand. As the weeks went by the monsoon turned out to be extremely favourable in even the single groundnut-producing State. Prices began quickly to decline under the anticipated pressure of a large harvest. The bear trend was further accelerated by the measures taken by the Government against hoarding and profiteering. The widespread arrest of smugglers and anti-social elements

new dispensation further discouraged the tendency to buy goods in anticipation of higher prices and to corner markets by speculative elements.

By the middle of July the price of groundnut oil had declined to around Rs 6,875 per tonne. The decline had been sharp enough to warrant a technical correction. The market therefore rallied to around Rs 7,800 per tonne by the middle of August. But by this time the crop position had become clearer. The pressure of arrivals at the terminal centres began to increase and the psychology of lower prices had begun to exert its influence which by no means was small. Towards the third week of September the market was distinctly weak declining to Rs 5,650. There was a sharp rally again to Rs 7,600 some time in October. Thereafter the market resumed its journey along the main bear trend and the lowest level of Rs 5,175 for the year was touched on November 22.

Current levels are low enough for the market to stage a recovery, as it should and as it probably will. All the same the basic trend in edible oils not only in this country but in the world markets is distinctly bearish. This is induced by the very good harvest of soyabeans both in the United States and Brazil, the latter preferring to sow soya in preference to its traditional coffee. Estimates are that by the middle of 1976 Brazil would harvest 14 million tonnes against the current year's final outturn of 9.7 million tonnes and last season's 7.5 million tonnes. During January-August this year, Brazil exported 2.33 million tonnes against 1.83 million tonnes of soyabeans, 1.94 million tonnes of soyameal against three-quarter million tonnes and a sizable quantity of soya oil against nil in the corresponding period of last year. Peruvian fishmeal, a rival to oilcakes, appears to be abundant and reliable reports indicate that an overwhelming percentage of 900,000 tonnes of the ensuing season's anticipated catch is already contracted for. The United States is also harvesting an abundant soya crop of 25 million tonnes. Soviet Union is an active buyer in the US and Brazilian markets but even then the total world harvest is adequate enough to exert a bear pressure on the market and keep the prices of edible oils at reasonable levels.

Exports of groundnut extractions have been rather disappointing with less than 400,000 tonnes sold during the first ten months of the year fetching Rs 42 crores compared with 5.87 lakh tonnes during the corresponding period

of last year earning Rs 74 crores. The unit value has also declined from Rs 1,260 per tonne to Rs 1,030 in the ten-month period of the current year.

The share of the Free Currency Area fell sharply—from 1.98 lakh tonnes in the first ten months of last year to just 69,000 tonnes in the same period of the current year. Correspondingly, the earnings declined from Rs 26 crores to Rs 6.7 crores. The target of exports to FCA is 30 per cent of our total quantity but during the period under review the percentage was hardly 17 against the actual achievement of 33 during the last year. The decline in the exports to the Free Currency Area is due mainly to competition from soyameal in the world market. The price of soyabean has declined over the year from 250 dollars per tonne to 170 dollars while soyameal has dropped by about 60 dollars. Obviously this has affected the competitive position of Indian extractions in the overseas markets. The feeling in market circles is that exports to hard currency areas could be stimulated by means of some sort of selective cash assistance. If this is done the country could take advantage of the vast European and Japanese markets; the EEC is producing 60 mil-

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lion tonnes of compound feeds and Japan 17 million tonnes. But the price of Indian groundnut extractions, if we mean to sell, ought to be at a small discount on soyameal prices. The groundnut crop this year has been very satisfactory and India could benefit provided our export policy is sensible and pragmatic. An influential market source calls for the total abolition of the export duty on groundnut extractions besides an export incentive of 10 per cent on the f.o.b. values and a 50 per cent increase in the import quotas of the East European countries.

India has done well in respect of the exports of HPS groundnuts; the figure is likely to cross the 1,00,000-tonne mark in the season that is ending with October 1976. Shippers are reported to have contracted for 40,000 tonnes. Most of this is going to the hard currency areas. The Rupee Payment Area has taken just a little over 1,200 tonnes. However, exporters think that the total cftake from this Area would be about 30,000 tonnes before the end of the season.

Table I : Oilseeds and oils — Price range

		1-1-1975	High	Low	24-11-1975
Groundnut Karad	360.00	366.00 (16-4-75)	244.00 (22-11-75)	244.00	
Groundnut oil	81.75	85.00 (22-4-75)	51.75 (22-11-75)	52.50	
Castor Madras Small	216.00	220.00 (3-1-75)	146.00 (30-9-75)	173.00	
Castoroil Common Ready ..	46.50	46.50 (1-1-75)	33.00 (24-9-75)	38.75	
Castoroil B.S.S.	50.00	50.50 (4-1-75)	37.00 (30-9-75)	42.50	
Linseed Bold	330.00	334.00 (2-1-75)	212.00 (5-7-75)	224.00	
Linseed oil	76.50	78.00 (2-1-75)	46.25 (6-11-75)	48.50	
Standard gold	520.00	574.00 (2-5-75)	511.00 (29-9-75)	552.00	
Silver .996	1,100.00	1,425.00 (8-8-75)	1,001.00 (5-4-75)	1,174.00	
Opening on					
Castorseed April 1975 ..	237.25 (23-8-75)	258.00 (18-9-74)	164.00 (21-2-75)	190.00 (30-4-75)	
Linseed April 1975	239.25 (30-8-74)	354.50 (17-9-74)	224.50 (21-2-75)	269.00 (30-4-75)	
Castorseed Sept 1975 ..	180.25 (17-6-75)	187.87 (29-7-75)	145.50 (29-9-75)	145.50 (30-9-75)	
Linseed Sept 1975	244.25 (17-6-75)	256.00 (23-8-75)	215.50 (7-7-75)	237.00 (30-9-75)	
Castorseed April 1976 ..	170.25 (20-8-75)	172.00 (23-8-75)	141.50 (30-9-75)	164.62 (24-11-75)	
Linseed April 1976	231.00 (20-8-75)	237.50 (26-8-75)	195.50 (30-9-75)	215.00 (24-11-75)	

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The opinion in trade circles is that efforts should be made to get hold of the Japanese market. Japan imports about 50,000 tonnes of peanuts. Hong-kong and Singapore are also good markets. However, Japan might prove a tough market in view of quality restrictions. Spanish peanuts are said to meet with Japanese requirement better.

Castor and linseeds

The trend in castor and linseeds has been bearish. For the 1974-75 season a castor crop of 2.5 lakh tonnes had been estimated but the harvest in the 1975-76 season (December to September) is expected to total not more than 2.25 lakh tonnes in view of the lower sowings in Andhra Pradesh. Exports of castor oil total around 22,000 tonnes and commitments are said to exist for another 9,000 tonnes up to March 1976. Trade circles comment that the State Trading Corporation missed many chances. Russian offtake this time has been rather small at 5,000 tonnes.

The decline in world prices of castor oil has been sharp. At the moment the price is 550 dollars per tonne against 800 dollars in the begin-

ning of the year. The trend has been bearish despite the shortfall in the Brazilian crop and this is attributed to a large carry-forward stock. It may be recalled that in 1972-73, castor oil fetched as much as 1,045 dollars per tonne.

The 1974-75 harvest of linseeds is estimated at 5.5 lakh tonnes. Exports of linseed oil have been satisfactory. About 70,000 tonnes of linseed cakes have been sold on overseas account. Crop outlook for 1975-76 has been very good at 6.65 lakh tonnes. Export prospects for oil are considered bright in view of a smaller Argentine crop. The market in linseed oil is bearish. The price at the moment is 550 dollars against 900 dollars this time last year. Decorticated cottonseed extractions have done well in the export market. Sales in the ten months to the end of October have been around 1.6 lakh tonnes against 1.24 lakh tonnes in the corresponding period of last year but in the same period of 1973 exports had been 2.35 lakh tonnes. The Government has announced an export incentive which works out to Rs 100 per tonne. The trade sees no difficulty in India selling a total of two lakh tonnes.

Table 1 on page 375 sets out the price range of some of the important commodities:

proved their metal flow and inventory control methods; corporations are likely to be cautious in their buying while the cost of money remains high in many countries and consumer confidence lacking.

Commenting on the world copper market situation, a US analyst said that there were fewer optimists now than there had been all the year. Copper prices in the New York and London markets had shown very little movement as indicated in the American metal market quotations (See Table 1).

Table 1: American metal market quotations (US cents/lb)

	Mid-Sept. 1975	Mid-Oct. 1975
LME cash copper ..	54.82	53.1
US Producer price ..	63.00	63.0
Comex nearby month	55.80	54.5
Merchant copper ..	58.00	55.2
No. 2 copper scrap ..	42.00	41.5

The Comex quotation for December was below 55 cents while some metalmen were actually expecting recovery in the US prices.

Some observers called attention to the fact that there was a spread of cents per lb between the LME and the US producer price in October. A market analyst wondered whether there would be a squeeze on the US producer price if the LME continued to show below the 53 cents per lb level.

In India the position is well set to achieve self-sufficiency in copper by the end of sixth plan, if vital investment decisions on the development of new deposits located in Malanjkhar (Madhya Pradesh), Rakha and Surkhet (Bihar) are taken without delay, according to Mr D. K. Dhaon, chairman, Hindustan Copper Ltd.

He feels confident that indigenous copper output could be stepped up more than five-fold from current levels to one lakh tonnes by the mid-80's. The capital outlay for expansion of mining capacity would be about Rs 200 crore at current costs with only a fifth of the expenditure in foreign exchange. Imports would even otherwise cost over Rs 160 crores during the period at current London market prices. It all would depend on how the Government and planners allocated resources on the basis of national priorities.

The offtake of copper had slumped to 33,000 tonnes last year and it might increase to 40,000 tonnes this year. Consumer demand for the metal in India has been estimated at 45,000 tonnes per year. During the current plan period it was unlikely that demand would cross the 65,000 tonnes level. It might rise

COMMODITY MARKETS—4

Metals: Steady downward trend

From OUR OWN CORRESPONDENT

CALCUTTA.

IN contrast to last year's boom conditions, the non-ferrous metals market in Calcutta swung to the other extreme this year with prices showing a steady downward trend. A pronounced contraction in consumer demand caused by the recessionary trend evidenced in certain sectors of the engineering industry and stiff resistance at higher levels led to a depressed sentiment. The metal availability also improved substantially following a marked expansion in indigenous production.

On the London Metal Exchange prices tended to slump on an unprecedented scale. The average monthly price for copper wirebar shot up to £626 per metric tonne from the opening rate of £512.73 but fell sharply to £498 before winding up at £575.38 in November. Zinc also opened at £338.20 in January and rose to a high of £363 before dipping to £304 and ended at £344.09 in November. Lead commenced at £227.86, spurted to £229.50 and re-

acted to £143.50 before closing in November at £164.56. Tin began at £3,258.41 and after touching a high of £3,470 slumped to £2,960 before closing in November at £3,055.20.

According to a study on copper trends made by Amalgamated Metal Trading Limited, a well-known London firm of brokers, consumption of refined copper declined by 6.6 per cent, in the western world last year having risen by 11.1 per cent in 1973. In the first half of 1975, it fell by 23.3 per cent, by 44 per cent in the US compared to last year. In the second half, demand may pick up by a shout 3½ per cent over the first half due to increased offtake by about 14½ per cent in the US and 6 per cent in Japan. For the whole year consumption is estimated at 5.36 million tonnes, 17.3 per cent less than last year.

The recovery in demand for copper from the depression of 1974-75 may not follow the historical pattern of a sharp upswing brought on by inventory replenishment. Most fabricators have im-

00,000 tonnes annually in the next period. A task force set up by Planning Commission had estimated demand at 84,000 tonnes in 1972-73, 105,000 tonnes in 1975-80. These projections had become completely out of date in today's context. Domestic production of the metal in 1975-76 would be up to 25,000 tonnes and increase further to 35,000 tonnes in 1976-77. With the increase in indigenous production, the availability of copper from domestic sources would naturally improve and exports in 1976-77 would decline to about 100 to 2,000 tonnes.

He stressed the need for greater co-ordination between HCL and MMTC for efficient utilisation of foreign exchange. The Director-General of Technical Development had already taken steps in this direction. The 31,000-tonne Khetri copper smelter would produce 20,000 tonnes annually and it would not be able to sustain a production of more than 25,000 tonnes until the mining capacity is developed sufficiently. There is no need to set up additional smelting capacity in the Sixth Plan period. The smelter would produce 8,000 tonnes from indigenous ores this year. Concentrates would be imported to supplement indigenous ores to achieve 50 per cent capacity utilisation in 1976-77 and it would be stepped up further to 70 per cent.

In view of the sharp fall in copper prices from £1,400 a tonne to about £575 on the London Metal Exchange within a span of 15 months, the copper-using industries in India had been pleading for a corresponding adjustment in MMTC's release prices which remained unchanged at Rs 26,000 a tonne.

The LME average price for wirebar declined from £587.32 in the fourth quarter of last year to £532.33 in the first quarter before recovering slightly to £541.21 in the second quarter this year. The average LME price for the first nine months this year was only £551.60 per tonne. While fixing the prices for any quarter, the MMTC took into consideration the previous quarter's average prices of LME, but this principle was overlooked after the first quarter and its release prices were not adjusted in line with the LME trend. The MMTC had large stocks of high-cost copper in its inventories early this year against its imports under long-term contracts, but now its price should be, according to Bombay Metal Exchange, not more than Rs 22,000 per tonne after providing for its high rate of commission.

The BME has suggested that the MMTC can reduce its prices if it still

held large stocks to save on the overheads and interest charges and cover the loss, if any, by booking lower-priced metal in world markets at current levels. However, it cautions that pegging copper prices at "artificial" levels will only starve the industry of essential raw materials.

Lead prices were reduced by about Rs 1,000 by the MMTC in the last quarter: For the 99.99 per cent grade from Rs 8,855 to Rs 7,855 for actual users, Rs 8,760 to Rs 7,760 for actual users (P) and Rs 8,375 to Rs 7,475 for REP users; and for the 99.97 per cent grade from Rs 8,765 to Rs 7,765, from Rs 8,670 to Rs 7,670 and Rs 8,285 to Rs 7,385 for the respective categories. The LME monthly average prices during the period January to November are given in Table 2:

Table 2: LME monthly average prices of lead (January-November)

				(Per tonne)
January	..	..	..	£227.86
February	..	..	..	£226.15
March	..	..	..	£224.53
April	..	..	..	£202.33
May	..	..	..	£181.90
June	..	..	..	£154.86
July	..	..	..	£164.45
August	..	..	..	£181.46
September	..	..	..	£172.97
October	..	..	..	£167.65
November	..	..	..	£164.56

In the Calcutta market lead opened the year at Rs 8.80 per kg and moved up to a peak of Rs 9.50 before receding to Rs 8.20 following a sharp fall in demand as the main users, namely battery manufacturers and alloy makers, were hit hard by demand recession. The MMTC had ample stocks in the pipeline which effectively curbed speculative tendencies. The supply outlook improved following steady arrivals on MMTC's account under its long-term contracts with overseas suppliers.

MMTC's release price for high grade zinc was reduced from Rs 14,675 and Rs 14,135 to Rs 13,740 and Rs 13,200 for actual users and actual users (P) respectively. But for the REP users, it was hiked from Rs 11,115 to Rs 12,500. For zinc special high grade the price was reduced from Rs 14,825 to Rs 13,895 and from Rs 14,285 to Rs 13,355 for actual users and actual users (P), while it was raised from Rs 11,265 to Rs 12,650 for REP users. For the Prime Western grade the prices were reduced to Rs 13,590 and Rs 13,050 from Rs 14,525 and Rs 13,985 for the AU and AU(P) users but for the REP consumers it was raised to Rs 12,350 from Rs 10,970.

The monthly LME average prices

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for zinc during the first eleven months of this year are given in Table 3:

Table 3: Monthly LME average prices for zinc (January-November)

(Per tonne in sterling)

January	..	..	..	338.20
February	..	..	..	331.43
March	..	..	..	332.08
April	..	..	..	330.07
May	..	..	..	321.90
June	..	..	..	329.23
July	..	..	..	323.62
August	..	..	..	348.44
September	..	..	..	347.24
October	..	..	..	343.07
November	..	..	..	344.09

In the Calcutta market zinc opened at Rs 15.50 per kg at the turn of the year and moved up to Rs 16. But prices declined later to Rs 15. Consumer off-take showed a perceptible fall following a steep drop in galvaniser activity. The MMTC also had large stocks for off-the-shelf delivery to actual users. This factor restrained the bullish elements which played a prominent part in boosting the prices to record levels a year ago.

A substantial increase in the domestic output of zinc is visualised by the end of 1976-77. The public sector producer, Hindustan Zinc Ltd, hopes to commission its 30,000 tonnes a year smelter complex at Visakhapatnam, based on imported concentrates by the third quarter of next year. Its Udaipur smelter capacity in Rajasthan will also be stepped up to 45,000 tonnes a year before long. It is hoped that zinc imports will fall substantially in the coming years.

The sharp fall in domestic off-take has forced the MMTC to go slow on its imports during the current year. Imports of copper, lead, zinc, tin and nickel declined to about 58,177 tonnes worth around Rs 61 crores during the first eight months of this year against 67,340 tonnes (Rs 74 crores) in the same period last year. Zinc imports totalled 26,000 tonnes valued at Rs 18.50 crores, lead 14,000 tonnes (Rs 6.45 crores), tin 1,250 tonnes (Rs 7.13 crores) and nickel 2,500 tonnes (Rs 8.66 crores).

In the last quarter, the MMTC raised its tin prices for actual users from Rs 89,950 in the preceding quarter to 96,845 tonnes for actual users, Rs 89,615 to Rs 96,545 for AU(P) and Rs 88,040 to Rs 95,445 for REP users. On the open market, tin ruled steady early this year at Rs 116 per kg and after climbing to a high of Rs 122 settled at Rs 117 at the end of November.

COMMODITY MARKETS—5

Hides and skins: Export earnings soar

From OUR OWN CORRESPONDENT

MADRAS.

THE Indian leather industry has come to play a key role in the country's efforts at earning much valued foreign exchange to maintain its balance of payments in the international trade. In the last few years, the export earnings of the leather industry have gone up to an appreciable extent from about Rs 100 crores in 1971-72 to about Rs 200 crores in 1973-74. On the eve of the International Leather Fair, an annual feature, at Madras in January, the Director of the Central Leather Research Institute expressed the hope that with the increase in demand for Indian leather, particularly for finished leathers, the country's exports of leather and leather goods would reach a target of Rs 600 crores by 1978-79. To achieve the target, governmental measures were under way to help the tanners to switch over to the manufacture of finished leathers from the traditional vegetable tanned or semi-tanned leathers which have been the mainstay of the country's exports of leather.

The trade, it should be said, had a boom period, particularly in the latter half, when demand far exceeded supply. This was attributed to the non-availability of supply from China, Bangladesh, Pakistan and the South American countries, and it was generally felt that there may be a shortage of skins all over the world in 1976.

The quota for semi-tanned hides and skins for the year 1975-76 has been set at the same level as last year but rumours are afloat that there may be a cut of about 25 per cent by about January 1976 to make available leathers for finished leather manufacturers at better prices to boost finished leather exports in pursuance of the avowed policy of the Government since 1972.

There have been moves by the Government to merge both the export promotion councils at Kanpur (for finished leathers) and in Madras (for EI tanned leather) into a single organisation with headquarters in Delhi. This move has perturbed the minds of most of the Madras tanners. As a majority of the traders are in Madras, they have made strong representations to the Government to have the headquarters located in Madras.

Further, the Union Government is also considering opening of Leather Development Corporations in various

regions for the development of finished leathers but, here also, the Madras exporters have requested for a better bargain in view of their larger participation in the trade as a whole.

The market, which closed on a subdued note last year, started looking up from about January end and the trade's expectations for a firmer market and better turnover were gradually realised. Inquiries from all quarters poured in spontaneously, including for finished leathers, which were accelerated during the second half, particularly for EI kips, calves and skins with the exception of, perhaps, prime sheep skins. The wet blue chrome goat and sheep skins continued to be the main item of interest to the USSR and other East European countries.

However, despite the great demand for semi-tanned leather including wet blue material, the volume of turnover had necessarily to be curtailed on account of quota restrictions, the acute water scarcity in tanneries during the earlier part of the year, drastic power cut and the very high raw prices, besides tight money conditions. The easing of the first two factors in July/August brought great relief to the tanners but mounting raw prices against limited arrivals prevented any liberties to the tanners as far as prices were concerned.

Tanned kips and calves

The United Kingdom, the traditional buyer, stayed away from the market in the beginning on account of economic conditions, and the uncertainty of the pound sterling in the international money market, allowed caution and indecision to reign supreme in place of stability, confidence and clear trends, and inflation the world over permitted trading on a "hand-to-mouth" basis only. Further, the UK buyers' anxiety over the result of the referendum as to whether Britain should stay in the European Common Market and the confusion over the 25 per cent luxury rate of VAT (value added tax) being applied to hides caused concern in the trade circles—it was soon clarified that hides and skins of bovine animals would rate for only 8 per cent VAT and led to stagnation of free flow of business for some time. The enhancement of freight rates by about 12½ per cent from about the beginning of the year also had a dampening effect, but with the reopening

of the Suez Canal and the consequent withdrawal and/or scaling down of various surcharges eased the position considerably.

EI kips: The premium and super premium type cow lights or 5/5½ and ages R/4/5 were in demand from March till September persistently at prices for which registered an increase of about 33d from January levels 126/116/106 to 159/149/139 and, thereafter, remained quiet due to slackness in demand. However towards the end of the year inquiries were being revived from the UK, which were viewed as a sequel to the demand for 8/8½ and 10/12 lb which were picked up in demand tremendously, particularly after the Paris Leather Fair and their prices fluctuated moderately in line with the demand.

(8/8½ R/IV/V January 113/109/—122/118/108 September 127/120/November and 10/12 R/IV/V 96/94 January 98/96/92 May 92/90/87 September 100/98/93 November). The inferiors of 5/5½ lb were in good request up to May and thereafter dropped considerably, whereas the inferiors of 4/4½ and 4/4½ were in good demand both locally and for export and generally tanners preferred the local market to better prices paid by upcountry traders.

EI calf: In cowcalf the market remained firm throughout with good flow of inquiries from the UK and Continent. The top class 1½/2 lb R/4 which were around 225/205 in January touched 290/270 in May and 320/300 in November, an increase of nearly 100d, attributed mainly to the shortage of skins, the buyer being Italy though the UK also paid up to 310/290d. In 2/2½ lb also prices spurted by about 90/100 from the January levels.

Buffcalf, which had a lean season last year against bulk supply, remained listless till March when the season of quality buffcalf skins came to an end, and, surprisingly, thereafter the selections were in good request and the available stocks were cleared at very handsome prices ranging up to 270d for 1½/2 lb run and 250d for 2/2½ lb run. In September from 210 and 190d in January. However, the advent of the new season brought about an unsteady effect on the market as far as prices were concerned. Tanners were highly perturbed with the way the raw prices soared against limited supply—a factor unforeseen due to floods in northern India and due to the feverish activity of the finished leather manufacturers. Hence prices kept up jumping day by day and were around 310/290 for 1½ lb R/III and 300/280 for 2/2½ lb. This was mainly due to the 200 per cent increase

in the raw prices and even at level tanners were not confident of living up with demand in the wake of bulk inquiries from the UK and Italy.

Buff hides: The EI semi-tanned hides occasionally but demand for chrome finished buffaloes was seen in fair amount from the UK, Continent and the USA.

Tanned goat and sheep skins

In tanned goatskins there was an upward trend in prices from last year to exceedingly good call from the UK and the Continent particularly Italy. It also followed the market to a certain extent which helped to maintain length in the prices. The importers' resistance to price increases was of no avail as raw prices ruled firm all round against poor arrivals.

The prices of 5½/6, 8/9, 11/12, 15/16 and 22/24 lbs run which were around 290p, 270p, 170p and 130p picked up gradually and were at 450p, 350p, 230p and 165p respectively by November with corresponding increase in the prices of fifths and inferiors. Even the lower ends which were sticky till September started moving for export, both semi-tanned and finished leathers. Towards the close the offers were scarce and tanners were reserved as they seemed to watch the situation against very poor arrivals from raw countries.

In tanned sheep skins, superfine and hair types had better market in UK/V/IF up to September registering an increase of about 95p all round in prices but after the Paris Leather Fair, the market declined gradually owing to dearth of buying interest resulting in a decline of about 25p in prices. On the other hand semi primes ruled steady throughout with the exception of lower ends from inferiors downwards which also picked up in the latter half. Tanned woolsheep skins were followed by Continent, particularly by France and Japan constantly. The market remained cheerful throughout and prices shot upwards since May by about 4 to 5p/ft. Japan also evinced interest in the heavier averages of hair and woolsheep in the second half of the year resulting in short supply. The Continent was a keen buyer of semi-chrome finished leather from India both from semi-prime hairsheep and woolsheep in selections ranging from run up to double loose inferiors for garments and linings. Raw sheep prices ruled steady to firm throughout the year.

Table 1 gives the shipments of hides and calves (600 lbs each bale)

and goat and sheep skins (560 lb in each bale) in bales. (Approximate figures only).

The Leather Export Promotion Council, Madras has given the export figures of EI tanned hides and skins, wet blue chrome and finished leathers and other items in 1973-74 (April/March) 1974-75 (April/March) and 1975-76 (April/October). (Table 2).

A comparative study of the export figures in Table 2 for the year 1975-76 (April/August) with that of 1974-75 (April/August) reveals that the exports of EI hides and skins had a slight increase of about 5 per cent in the overall figure which should be attributed to the better demand for EI leather due to world shortage. However, the value has gone down by about 9 per cent which can be attributed to the offtake of lower ends in bigger quantity.

A study of the export figures of wet blue chrome and finished leather reveals that while the exports of the former have declined by about 7 per cent as compared to the first five months of 1974-75 it is heartening to note that the exports of the latter have gone up by about 40 per cent in terms of value.

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With more and more of EI tanners switching over to finished leather manufacture against the great demand as seen during and after the Paris Leather Fair from the western countries, the exports of finished leather are sure to double up or increase even more at this time next year.

The future prospects for finished leathers do seem very bright in the light of recent inquiries but it is up to the tanners and manufacturers to cater to the demand and meet the terms of the buyers in this highly specialised sphere. Regarding EI tanned hides and skins, the demand is very good at present due to world shortage. However, it would be advisable for the tanners to take up manufacture of finished leathers without losing time because even if the demand for EI leathers persists they cannot hope to do much against the quota restrictions. In fact it would be better for the tanners to join hands with the Government in promoting the exports of finished leathers—the sooner the better.

Table 1 : Shipment statistics

			Cowhides	Cowcalf	Buffhides	Buffcalf	Goat	Sheep
UK								
1973	..	..	20,143	3,158	958	4,250	1,503	1,674
1974	..	..	13,050	2,680	—	3,628	803	1,099
1975	..	..	10,880	2,337	—	2,527	413	973
Jan./Sept.	..							
CONTINENT								
1973	..	..	407	205	192	1,173	8,512	5,425
1974	..	..	543	269	—	2,667	8,921	7,431
1975	..	..	122	50	—	1,036	3,063	2,029
Jan./May								
USA	..							
1973	..	..	52	10	755	93	158	143
1974	..	..	20	—	337	25	96	286
1975	..	..	—	—	130	25	103	21
Jan./April	..							
JAPAN								
1973	..	..	—	—	—	30	936	1,297
1974	..	..	—	—	—	32	1,079	1,404
1975	..	..	—	—	—	—	759	1,108
Jan./May								

Table 2 : Exports of EI tanned hides and skins since 1973-74

(Figures in lakhs)

		Hides		Skins		W/B		F/Leather goods	
		Qty. kg.	Value Rs.	Qty. kg.	Value Rs.	Qty. kg.	Value Rs.	Qty. kg.	Value Rs.
1973-74	..	102.73	2402.91	92.14	6803.00	201.61	6139.48	29.23	2283.77
1974-75	..	82.75	1718.83	72.99	5352.67	120.64	3528.01	56.23	4493.99
1974-75	..	37.86	900.95	29.60	2426.12		1732.40		1936.91
(April/Aug.)									
1975-76	..	39.06	730.87	31.12	2306.65		1612.97		2690.94
(April/Aug.)	..								

COMMODITY MARKETS—6

Bullion: Gold finds its level

From OUR OWN CORRESPONDENT

BOMBAY.

EARLY in 1975, with the United States permitting its residents to hold gold, the yellow metal showed a rare buoyancy that pushed up its price to a level just below \$200 an ounce. But the world gold markets received two shocks in the form of reluctance of Americans to buy gold and the IMF decision to sell part of its gold holdings that saw the level plummeting back into the \$140 range before gold seemed to settle down in the free market around the \$140 level towards the end of the year.

Gold, more than at any time before, is a commodity, but as experts point out, still a commodity with many monetary characteristics that make it a subject of discussion of central bankers and the International Monetary Fund. Despite the US attempts to reduce its importance a clear answer about the ultimate monetary role of gold is still not available. This is why the violent fluctuations in its prices during 1975.

Since 1968 the gold market has seen various pulls and counterpulls. That year saw the collapse of the official gold pool and the central banks giving up their attempt to keep down the prices in the free market near the official price of \$35 an ounce. Three years later in August 1971 the United States announced the suspension of gold convertibility into the dollar, which logically meant there was no particular meaning in having an official price for gold. Governments were left free to revalue their official gold stocks at the market price though the central banks accepted a convention of not buying gold in the free market. Then at the beginning of 1975 came the US announcement that Americans could hold gold and the market was agog with the expectations that there would be a rush for gold in this rich country.

However, nothing of this kind happened and the 2 million ounces which were put on the market by the US Treasury found only institutional customers from outside the country. If this was not enough to depress the market the IMF decision in September to sell one-sixth of its gold holdings or about 25 million ounces to create a fund to help the developing countries was enough to turn the markets nervous. The price crashed to just below \$130 from \$160 prevailing on the

eve of the IMF meeting even though it was clear that no immediate action by the IMF was possible on the decision. This was because, first, the decision had to be ratified by the member-governments of the IMF and, secondly, it was known that no implementation would be possible until the US and France had reached some agreement on the exchange rates. Financial experts had been quick to point out that an accord between the two countries would not be reached before the meeting in January 1976 of the International Monetary Fund's Interim Committee in Jamaica.

The sharp drop in gold prices may nor may not have unnerved speculators, and many still believe that gold is still not that unwanted in the Arab and some of the Asian countries where it has always commanded attraction. But it certainly caused jitters in South Africa, the largest supplier of gold. The South African Government announced a devaluation of 17.9 per cent of its currency, the rand, mainly with a view to helping its gold mining industry. This did come about with the mines finding an increase in their rand proceeds of 22 per cent, which meant restoring the revenue in rand to the levels which were obtained immediately before the IMF meeting when the price was in the range of \$160.

Will the price stabilise at the year-end level of \$140 an ounce or see some sharp fluctuations? A definite answer would be hazardous. But obviously South African gold industry does not foresee a possibility in the near future of a rise in prices as is evident from its critical re-examination of investment programmes in the light of the effects of the lower gold prices in recent months and the continuing prospect of increasing cost of production. The IMF itself would not like to see the price dropped by a sizable margin since that would affect the size of the fund being created for helping the developing countries. Immediately after the September meeting the figure talked about of realisation from the sale of 25 million ounces of gold was \$2.5 billion to \$2.8 billion, which gives a fair idea of the floor price the IMF has in mind.

The developments since the IMF meeting have led to a revision of ideas about the possible realisation from the sale of 25 million ounces and the as-

sumption now made is that no more than \$1.5 billion might be available for the Trust Fund to be created for helping the developing countries. Even the disposal of the gold is expected to take three years or so, which means only half a billion dollars will accrue to the Trust Fund every year.

This by itself has been a disappointment to the developing countries as they have also been disturbed by the fact that the creation of the Trust Fund is linked to the abolition of the official price of gold and the return of one-sixth of the gold to member countries in proportion in which contributions were made by them. In other words, more gold will flow back to the industrial countries than to the developing countries. This, it is feared, would put in the hands of a few countries with large gold reserves excessive liquidity which will affect allocation of SDRs for a long period. What is more, no one would then bother about creating additional SDRs and, as the Union Finance Minister, Mr C. Subramaniam, has implied, the developing countries' demand for linking creation of SDRs to development finance would become academic. Gold thus continues to present complexities, whatever may be the ideal Group of Ten about its future role.

Silver

The behaviour of the gold market has always an impact on the silver market and, though the white metal does not show the same wild fluctuations as did the yellow metal, its behaviour was not strictly according to a predictable course. A strong feeling seems to be developing that though silver prices may move in the world markets in the range \$4 to \$5 an ounce during the next 6 to 12 months, a decline in prices could be expected at least in the latter part of 1976.

This assessment is based on three or four factors. First, the 1976 silver world production is expected to rise sharply to nearly 315 million ounces from the estimated 288 million ounces during 1975 and 297 million ounces in 1974. Secondly, world silver consumption is expected to decline in 1975 and 1976 by 30 million ounces from the figure of 497 million ounces in 1974. The silver gap which was 235 million ounces in 1973 and 200 million ounces in 1974 is consequently expected to be reduced to 177 million ounces in 1975 and 147 million ounces in 1976. It is being pointed out that due to high prices, capacity to produce secondary silver has increased and salvage production is expected to reach 80 million ounces in 1975 and

million ounces in 1976. Silver exports from such countries as India and Pakistan are also expected to be higher.

Exportation in India

The picture in India did not strictly reflect the behaviour of the two metals in the world markets. Gold, in fact, was firm even when the prices were dropping in the world markets and it was silver which was more erratic in its behaviour. The steep fall in over-the-counter gold prices had little impact in India because the inflow of the hard currency metal was poor. Silver, on the other hand, was influenced by the fact that India has emerged as one of the leading silver exporters and it was the volume of exports which dictated the market trend. Exports from Bombay between February 1974, when shipments were first officially permitted, and May 1975, totalled nearly 13.23 lakh kg, earning foreign exchange of nearly Rs 154 crores. Another 1.10 lakh kg of silver were exported between July 1975 and the beginning of November 1975.

Another factor that was in operation during the second half of the year must not be overlooked. The declaration of emergency and the detention of suspected anti-social elements made smuggling in gold and silver difficult. Only towards the end of the year some rumours were heard of the flow of contraband gold in small quantities. The market also talked of the Union Government having unloaded about 10 tonnes of gold from the seizures made on the international gold market. But both these reports could not be confirmed.

Standard gold opened steady at Rs 520 per 10 gm on January 1975 on reports that private buying would be allowed in the United States, but soon showed a declining trend. Seasonal demand and rumours of demonetisation, however, pushed up the price to Rs 562 by February 1975 before dropping to Rs 531 in March on large inflow at higher prices. The year's high of Rs 574 was reached in May on heavy purchases by Punjab dealers who were rumoured to have sold this stock to Pakistan.

But the promulgation of emergency changed the picture and when, further, in September the IMF announced its decision to sell gold the level dropped to the low of Rs 511. The downward trend was also accentuated because of the reported heavy selling by money-lenders of gold ornaments in the wake of debt relief legislation in various States. Another depressant was the reports that the Tirupati Devasthanam

might sell about a tonne of gold in the open market. But later it became known that the Tirupati gold had been earmarked for industrial consumers and, when the seasonal festival demand emerged, this helped the 'yellow metal' to stage a sharp recovery to Rs 560 by the middle of November.

At the year-end, however, standard gold was being quoted at less than Rs 530. One influence at work may have been the voluntary disclosure of income scheme announced by the Government. An ordinance issued on November 29 provided immunity from confiscation, penalty and prosecution under the Gold Control and Customs Act to those who declared their concealed income or wealth by December 31, 1975. Persons claiming immunity, it was announced, would have to make a declaration regarding the gold ornaments and articles owned by them before February 1, 1976. Where the concealed income or wealth was held in the form of primary gold, the gold would have to be either sold to a licensed dealer or converted into ornaments before that date. Where the gold was held by a licensed dealer he is required to make necessary entries into the account books, registers and documents

WORLD COMMODITIES

Prospect of price explosion

By PAUL CHEESERIGHT

NO new international economic order has emerged from the endless debates and the mountain of papers that have spawned a plethora of proposals over the spectrum of commodity politics. But what has resulted from the interaction of competing economic positions through the year has been a smoothing of the edges, so that the prospect of confrontation between producer and consumer has been diminished and the hope of co-operation increased.

In the long run it may well be that the mood of the commodity dialogue will be of more lasting importance than the generally unfavourable turn in commodity prices over recent months. But the fact of the price trends has made the dialogue a matter of pressing urgency, both for the producers with their need for equitable prices and for the consumers with their need for secure supplies.

The new international economic order as it emerged from the debates of the year involved a fundamental shifting of the economic balance

maintained by him under the Gold Control Act and take such other steps as were necessary for him to comply with the requirements of that Act before February 1, 1976.

Silver, like gold, also opened the year at a steady level of Rs 1,090 per kg for .996 fineness quality but by the first week of February had dropped to Rs 1,005 in the absence of exports and weaker overseas advices. By the middle of May, however, prices had rallied to Rs 1,174 because of large exports. But this in its turn resulted in the prices going out of world parity and the metal dropped to the January level in the first week of June. The strength in the world markets and shipments abroad of as much as 150 tonnes in July and August pushed up the price to a new high of Rs 1,427 in August. But the prices declined again when overseas advices were weak but recovered to Rs 1,234 on November 11 on fresh exports of about 30 tonnes during the first week of November. By the year-end silver .996 fineness was comparatively weaker at Rs 1,155.

away from the main consumers in the industrialised world. To that extent it was much ideological as economic, capable of realisation only by a political act of will on the part of the developed countries.

There was little evidence, however, that the developed countries were prepared suddenly to countenance a change in the economic order which would result in cuts in their prosperity. But what they were prepared to do was to accept the moral case for stability in commodity earnings and the need to work out schemes which would allow for the development of the primary resources of the developing countries.

Thus, plans from organisations like UNCTAD were met by the initiative of the British Prime Minister, Mr Wilson, at the meeting of the Commonwealth Prime Ministers' conference and the belated readiness of the industrialised countries to widen the French-initiated oil dialogue to cover the whole field of economic relations including commodities.

One effect of the debate has been to soften the edge of the argument by some primary producers on the merit of commodity cartels. It has been noticeable in recent negotiations concerning coffee and cocoa that the point has been taken that commodity organisations are not likely to work without the co-operation of those who consume and those who produce.

Partly, of course, this has been the result of economic circumstances. No commodity organisation can work unless people are prepared to buy what is produced. And the overwhelming concern of the leading economic nations with inflation and deflation, with recession and recovery, has reduced the power of the producers. Their bargaining power is greater when demand is strong and prices increasing.

That said, it is now apparent that there is a greater readiness on the part of the consuming nations to accept the manipulation of the markets through devices like buffer stocks, backed up negotiated systems to make up the export incomes of producers when they fall beneath pre-arranged levels. On the whole, the consumers have moved to the position where they would accept the organisation of commodity trading on a commodity by commodity basis.

This falls far short of an integrated programme as envisaged by UNCTAD, backed up by a 3 billion dollars cash fund with call on a similar amount of cash in the background. At the same time, the idea of indexing commodity prices to prices of industrialised goods has fallen on stony ground. Indexation was ruled out by Mr Wilson at the Commonwealth meeting. It is opposed by West Germany and the United States will have no part of it, despite its efforts to move more towards the points of view held by the producers.

"Any attempt to fix prices independent of market forces will ultimately run into trouble", said the US Assistant Secretary to the Treasury, Mr Gerald Parsky in July, and that summed up the general attitude in the developed world. Secure supplies and secure prices are one thing. An open-ended commitment to increase is another.

In fact, during the past year, market forces have not dealt kindly with the producers. Higher oil prices have played havoc with currency reserves and the balance of trade, despite the larger quantities of aid coming from the oil-producing world. Grain impor-

ters have had to contend with stimulus to prices caused by the sharp fall in the Soviet Union harvest time when their own receipts been lower.

The recession in the West has resulted in lower demand. Even consumer products like sugar consumption resistance has built up and pushed prices down to levels undreamt of in the middle of 1974. Coffee was an exception because of the Brazilian disaster, even though the overall supply and demand position is tending in favour the buyer rather than the seller.

In industrial commodities, the base metals, the producers have tried without success by market intervention on their own behalf or by slowing down of production and cutback of exports to redress the balance in their favour. Generally they have been unsuccessful and it is now anticipated that, in the case of copper for example, a large portion of even the world's most economic producers are having to sell below cost.

The markets overall have been dull and a great deal of what interest there has been has come from speculative sources banking on an upsurge in prices which has not yet happened. The prevailing level of silver prices owes much more to the large scale manipulation of the American market by speculators than it does to the industrial demand.

There was a feeling on the market that prices would begin to move upwards towards the end of the year in anticipation of an economic recovery in the early part of 1976. But this feeling has been dissipated, despite the measures taken to stimulate economic activity in continental Europe. The recovery in the USA has yet to prove itself soundly based.

And the USA is the key to higher prices. It is clear that the USA will lead the international economy back to higher growth levels. It is clear when that will take place. Recent suggestions are that this could be in the middle of 1976, in which case the markets could start climbing the spring.

But there is one danger. Product prices, especially of metals, has been run down and investment has been cut back. The producers are not necessarily in a position to meet heavy, sustained demand, once the stockpiles have been run down. There is the prospect of a price explosion. (Financial Times News Service).



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